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ABSTRACT

This publication is intended to serve as a practical guide to the development of relevant curricula for the education and training of environmental health professionals. This book aims to: (1) set out principles for developing policies on education and training for environmental health professionals at national and subnational levels; (2) formulate proposals for curricula that aid in conferring the necessary competencies to environmental health professionals; (3) support the upgrading of national capacities for education and training to facilitate national self-reliance in the prevention and control of environmental hazards; and (4) promote the harmonization of international efforts to upgrade the environmental health workforce in Europe. (WRM)

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ED 432 476

## Environmental Health Services in Europe

## 4

# Guidance on the development of educational and training curricula

by Martin Fitzpatrick

and Xavier Bonnefoy

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The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health problems of the countries it serves. The European Region embraces some 870 million people living in an area stretching from Greenland in the north and the Mediterranean in the south to the Pacific shores of the Russian Federation. The European programme of WHO therefore concentrates both on the problems associated with industrial and post-industrial society and on those faced by the emerging democracies of central and eastern Europe and the former USSR. In its strategy for attaining the goal of health for all the Regional Office is arranging its activities in three main areas: lifestyles conducive to health, a healthy environment, and appropriate services for prevention, treatment and care.

The European Region is characterized by the large number of languages spoken by its peoples, and the resulting difficulties in disseminating information to all who may need it. Applications for rights of translation of Regional Office books are therefore most welcome.

# Environmental health services in Europe 4

## Guidance on the development of educational and training curricula

4

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# Environmental health services in Europe 4

## Guidance on the development of educational and training curricula

Martin Fitzpatrick and Xavier Bonnefoy

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# Foreword

*The Third European Conference on Environment and Health, to be held in London in June 1999, will provide a timely opportunity to review the progress of the Member States of the WHO European Region in developing their environmental health services. Their commitment to this process of development stretches back over the last two decades through the European regional policy for health for all. This was followed up by the First European Conference on Environment and Health, held in Frankfurt-am-Main in 1989, which identified the groundbreaking principles underpinning environmental health in the European Charter on Environment and Health.*

*Five years later, the Second European Conference in Helsinki presented a clear path forward that all Member States could follow, through the development of national environmental health action plans (NEHAPs). In response to requests from countries for support in developing and implementing NEHAPs, the Regional Office set up a project to produce a series of publications dealing with all aspects of environmental health services management. The production of these publications has involved environmental health professional and institutions, international agencies, and not least the countries themselves. The first in the series provided an overview of how services are managed throughout the Region, and the second dealt with the variety of policy options that Member States might consider in organizing those services. The third publication in the series concentrated on the staffing of environmental health services.*

*This fourth book provides practical assistance in the education and training of environment and health professionals. This includes identifying relevant learning objectives, developing appropriate teaching methodologies, and proposing a range of curricula for various levels of professional. There was tremendous interest on the part of Member States and educational institutes in the development of this publication. The result is a book that is grounded in the realities of Member States who are endeavouring to equip their environment and health professionals to deal with the rapidly changing world in which they work. It also attempts to facilitate environment and health service providers and educational institutions in developing a common understanding of how to address the needs of these professionals.*

*The production of this fourth book involved lengthy discussion and wide-ranging debate among the many professionals and institutions consulted during its preparation. Their commitment, knowledge and experience were instrumental in bringing this work to fruition. The preparation of the book also provided a forum for a very diverse range of people from many countries to meet together and share their experiences.*

*I should like to thank Martin Fitzpatrick, on secondment to the Environment and Health Department at the Regional Office. The many consultants and advisers involved must also be thanked for the unstinting contribution of their time and talent. Finally, the support of the Department of Health and the Eastern Health Board of Ireland is warmly acknowledged.*

J.E. Asvall
*WHO Regional Director for Europe*

# Introduction

This book is intended to serve as a practical guide to the development of relevant curricula for the education and training of environmental health professionals. The range of relevant professionals, identified in a companion volume *(1)*, are addressed in further detail below.

In particular, this book aims to:

1. set out principles for developing policies on education and training for environmental health professionals at national and subnational levels;
2. formulate proposals for curricula that aid in conferring the necessary competences to environmental health professionals;
3. support the upgrading of national capacities for education and training to facilitate national self-reliance in the prevention and control of environmental hazards; and
4. promote the harmonization of international efforts to upgrade the environmental health workforce in Europe.

This Introduction provides an overview of the development of environmental health within the WHO European Region, and discusses various difficulties being faced by environmental health services. Some of these problems may be tackled by improving the competence and professional capacity of those working in environmental health services. A number of the concepts and principles that underpin this competence and professional capacity have been developed through a range of international agreements. Identification of these professionals is an important step in addressing these problems. The results of survey work carried out by WHO on this issue are presented and a model of the manner in which these professionals become involved in the area of environmental health is proposed. Finally, a brief overview is presented of the process and components of developing an educational programme.

Chapter 1 deals with the development of learning objectives, which basically set out those things that students should be able to do at the end of an educational programme that they could not do before. Developing relevant and achievable learning objectives is an essential element of any educational programme. For environmental health professionals, the overall objective is to support them in developing competence in their relevant field of study and eventually in their work. This concept of competence is discussed and relevant learning objectives are placed in the context of the objectives, functions, activities and tasks carried out by environmental health services in particular areas of concern.

In Chapter 2, the various approaches and methodologies for teaching environmental health are discussed. These include a description of some of the available teaching resources, as well as the locations and opportunities that exist for carrying out educational programmes for environmental health professionals. The range of appropriate approaches and methodologies available and their comparative advantages and disadvantages are also reviewed.

The evaluation of educational programmes has received particular attention in many quarters in recent years. In Chapter 3, the need for evaluation of educational programmes is discussed and a range of guidelines for evaluating various components of a programme are proposed. This process of evaluation is vital in ensuring the relevance of educational programmes offered to environmental health professionals.

In Chapter 4, curricula for various environmental health professionals are proposed. These curricula are based on the model of environmental health professionals presented in the Introduction, and are intended to form a template that may be adapted as necessary to suit national needs and those specific to different disciplines.

Annexes A–F deal with the modular details of these curricula, while Annex G provides guidelines for the development and evaluation of learning objectives for environmental health education programmes.

The target audience of this book includes: governments of Member States; subnational and local government authorities; educational authorities and institutions; private sector employers; economic sector employers; environmental health professionals; professional representative groups; and other nongovernmental organizations.

## TRAINING OF ENVIRONMENTAL HEALTH PROFESSIONALS

Many Member States in the WHO European Region have experienced profound change over the past 10 years. These have included, on the one hand, the break-up of the former USSR and the emergence of a greatly enlarged family of Member States. On the other hand, there has been a concerted drive by many countries (particularly in the context of the European Union) towards greater political and economic integration. For all Member States it has been a period of re-evaluating old alliances, forging new ties, and coming to terms with a wide variety of new circumstances. One result is that in some Member States, the institutions of state and the personnel who staff them are insufficiently equipped in terms of resources and competence to tackle successfully the many serious environmental health challenges that now confront them.

This situation was highlighted by a major survey of environmental health services carried out by WHO during 1993 and 1994, in the course of producing the first two publications in the series *(2,3)*. This survey also made it clear that the personnel employed by the environmental health services in a number of countries are struggling to deal with the effects of the socioeconomic changes currently taking place. The processes of decentralizing authority and building market economies require that environmental health services management capacities be considerably improved. There are also very great challenges facing all Member States in relation to dealing with transboundary environmental health issues, the role of the private sector in environmental health services, and increased political and economic integration within the Region.

In view of these challenges, there is a need for Member States to evaluate critically the relevance and quality of education and training being provided to students who will pursue careers in environmental health, as well as to address the needs of professionals currently working in the field. The cornerstone of such an exercise must be the range and quality of education and training programmes offered throughout the Region.

## BACKGROUND TO DEVELOPMENTS IN ENVIRONMENTAL HEALTH

The following is a very brief synopsis of the developments that have taken place in the field of environmental health in the European Region in recent years.

- In 1980, the European Member States adopted a common strategy for achieving health for all. This strategy focused on four main issues: lifestyles and health, health and environment, reorientation of health care systems, and mobilization of support to bring about necessary change. The main concepts underpinning this strategy are dealt with in more detail later in this book.

- In 1984, the Member States adopted 38 regional targets addressing these issues *(4)*, and these were revised in 1991 *(5)*. Nine of the targets are directly concerned with environmental health.

- In 1987, the report of the United Nations World Commission on Environment and Development, *Our common future (6)* advocated that human activities should follow a path of sustainable development, which it defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

- In 1989, the Regional Office organized the First European Conference on Environment and Health in Frankfurt-am-Main, bringing together for the first time ministers of environment and of health from 29 Member States. The Conference adopted the European Charter on Environment and Health *(7)*, which represents a major step forward in the development of joint public health and environmental policies.

- In 1992, the United Nations Conference on Environment and Development, held in Rio de Janeiro, brought together representatives from 179 countries, as well as governmental and nongovernmental organizations. In preparation for the Conference, the WHO Commission on Health and Environment produced a report *(8)* providing a comprehensive review of the world health situation in regard to environment and development. The Conference endorsed Agenda 21 *(9)*, a blueprint for socially, economically and environmentally sustainable development for the next century.

- Also in 1992, the European Community adopted its Fifth Environmental Health Action Programme *(10)*, which is now the European Union's central tool for implementing Agenda 21 within its functional area. The Programme is currently being revised and updated.

- In 1993, in response to the Rio Conference, WHO adopted a new global strategy for health and environment *(11)*. In the same year, in parallel initiatives by other United Nations agencies, a broadly integrating process through the ministers of environment was forged in the Lucerne Declaration *(12)*.

- In 1994, The Second European Ministerial Conference on Environment and Health, in Helsinki *(13)*, identified the framework for developing national environmental health action plans (NEHAPs). The ministers of environment and of health also called for the Regional Office to work in conjunction with other partners on developing the necessary mechanisms and guidance to assist countries in the development of environmental health services *(14)*.

## THE HELSINKI CONFERENCE AND THE ENVIRONMENTAL HEALTH ACTION PLAN FOR EUROPE

The framework for developing NEHAPs is described in detail in the Environmental Health Action Plan for Europe *(14)*, as endorsed by the Helsinki Conference in 1994. The key issues identified by the Action Plan include the need to support and strengthen environmental heath services and to develop, through appropriate education and training, a cadre of environmental health professionals able to manage and facilitate the implementation of structured programmes for the protection of environmental health.

With respect to education and training, the objective is "to provide education and training at all levels so as to create cadres and teams of environmental health professionals who will be responsible for implementing and managing specific programmes to improve environmental health".

The objectives relating to public information and health education include "(Ensuring and enhancing) participation of the public at the earliest stage in environmental health planning, priority-setting and programme implementation based on the principle of openness and equal partnership of all involved".

## THE WHO FOLLOW-UP TO THE HELSINKI CONFERENCE

The Regional Office has had an active programme on environmental health services in the Region for some years. To further develop the work carried out to date, and in accordance with its mandate from Helsinki, WHO has been developing a range of other initiatives. At a consultative meeting of Member States held in Vilnius in November 1994 *(15)* to discuss the follow-up to the Helsinki Conference, a number of project proposals were presented to the Member States for their endorsement. One such proposal concerned staffing, professional education and training for environmental health services.

The scope and purpose of the proposed project adopted by the Member States in Vilnius was "to build and strengthen the capacities of environmental health services, by improving the knowledge of the existing situation regarding the staffing of environmental health services and the education and training of environmental health professionals" *(15)*. The proposed products from the project include guidance documents dealing with the staffing of environmental health services in the European Region *(1)* and on the development of educational and training curricula for environmental health professionals.

## DEFINING ENVIRONMENTAL HEALTH

With such a wide array of professionals involved in environmental health, it is obvious that the term holds a variety of meanings and connotations throughout the European Region. In many countries the concept of environmental health has been developed over many years and is well established, while in others the term is relatively new, and its conceptual development with regard to the national situation is still evolving. In still other Member States, because of historical, political, cultural and linguistic factors, the conceptual equivalent for the term simply does not exist, and environmental health issues are approached from very different viewpoints. As a result of consultations organized by the Regional Office in Sofia in October 1993 *(16)* and in Vilnius in November 1994 *(15)*, a new definition of environmental health emerged:

> Environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical biological, social and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting and preventing those factors in the environment that can potentially affect adversely the health of present and future generations.

This definition articulates the desire of Member States in the European Region that environmental health should embrace quality of life, psychosocial factors and sustainable development.

These consultations also addressed the definition of "environmental health services". Even a cursory review of this issue will reveal the heterogeneous nature of the institutions at local, regional and national levels that deliver environmental health services in the countries of the European Region. The diversity that exists in relation to the interpretation of environmental health is equally applicable to environmental health services. One definition that has been proposed as a result of these consultations is:

> Environmental health services are those services which implement environmental health policies through monitoring and control activities. They also carry out that role by promoting the improvement of environmental parameters and by encouraging the use of environmentally friendly and healthy technologies and behaviours. They also have a leading role in developing and suggesting new policy areas.

In the final analysis, it is the prerogative of Member States to decide the kinds of institutions they wish to develop for delivering these services. While these institutions and organizational structures may vary, however, there are basic concepts or "signposts" in their development that should be taken into consideration. These concepts are discussed in detail elsewhere *(1)* and are summarized below.

## Health for all principles

The WHO health for all strategy for Europe *(4)* provides a cohesive framework for developing policies, strategies and interventions needed to address issues of environmental health The main concepts dealt with under the health for all strategy are the following.

### *Equity*

Environmental factors present in our societies, such as poor housing and overcrowding, have long been recognized as having serious deleterious consequences for physical health and wellbeing. The effects of these factors in relation to mental and social wellbeing are increasingly under scrutiny. The economically disadvantaged in our societies are all too often those who also live in the poorest living conditions, work in the most hazardous occupations, and have limited access to proper sanitation, clean water and a balanced, nutritious diet.

Environmental health services have a role in combating these inequities. The widening gaps between the rich and poor elements of society can often be gauged by the choices available to people regarding the environmental conditions in which they live. Promoting equity can have a significant effect in empowering individuals and communities to have a say in where and how they live, work and play.

### *Intersectorality*

The field of environmental health is one in which all sectors (including agriculture, forestry, energy, industry, transport and tourism) have a role. Isolated decisions and actions cannot solve environmental health problems. In many cases this approach causes new problems or exacerbates existing ones. While the virtues of intersectorality are espoused by many professionals dealing with environmental health issues, turning this declaration of support into reality involves sharing responsibilities and authority. It requires the pooling of skills and experiences, and in some cases putting aside vested professional interests. The benefits for all concerned – governmental authorities, the relevant professionals and the public whom they serve – far outweigh the perceived sectoral risks.

### *Public participation*

Fostering public participation in environmental health issues goes far beyond the dissemination of information to the public. Providing relevant and timely information that facilitates informed debate is in itself a worthy goal. However, real communication is a two-way process. The development of mechanisms and forums that empower the public to participate in the making and implementing of decisions is a crucial challenge facing environmental health services in the European Region.

### *Democratic principles*

The core values of democracy revolve around the concepts of individual and collective entitlements and responsibilities. These include: the rights of individuals to an environment conducive to the highest attainable level of health and wellbeing; entitlement to information and consultation on the state of the environment; consultation on plans, decisions and activities likely to affect both the environment and health; and the right of individuals to be involved in decision-making processes. It also includes the responsibilities of individuals, and of all sections of society, in protecting the environment in the interest of human health. Environmental health services share these responsibilities, and also have a vital role in asserting the democratic rights of individuals and society to participate in the decision-making process on relevant issues.

### *International cooperation*

Environmental health threats may have little regard for international boundaries, but concerted international cooperation and action have proved very effective in dealing with transboundary environmental health issues. The concept of international cooperation also encompasses the need for solidarity among countries and the prioritization of the needs of the worst affected areas in the Region.

### *Environmental health promotion*

This concept is based on three integrated actions – advocacy, education and lobbying. The advocacy role of environmental health services implies the defence of sound environmental health principles in a proactive manner. Environmental health services also have a major role to play in the area of environmental health education. Target audiences include politicians and policy-makers, professionals in other sectors, the general public, and workers within the environmental health services themselves.

It could be argued that environmental health professionals have a duty to make representations to governmental bodies on important issues. This can be achieved through a variety of consultative mechanisms. It can take place within the services themselves, as well as through consultation between government bodies and professional representative groups and other nongovernmental organizations.

## Other relevant concepts

In addition, there are certain relevant concepts that have been developed through other mechanisms and international initiatives.

### *Subsidiarity*

The principle of subsidiarity involves the delegation of decision-making powers to the level at which they will be most effective *(17)* and is seen as a means of ensuring that crucial actions are taken by the most appropriate stakeholders. This requires developing capacities at the most appropriate level for identifying priorities and assigning them to environmental health problems. It also requires support for developing environmental health institutions and services with the necessary decision-making, problem-solving and communication skills. It should be emphasized that the subsidiarity concept cannot be applied uniformly throughout the European Region, given the diversity of existing organizational structures.

### *Sustainable development*

Sustainable development is defined as "Development which meets the needs of the present without compromising the ability of future generations to meet their own needs" *(6)*. Sustainable development is a cornerstone principle for the development of environmental health services. It offers a comprehensive policy framework in which an overview can be made of all aspects of policy-making and implementation that have an impact on human health. The value of the concept of sustainable development has been generally recognized. Nevertheless, policies that give effect to the implementation of sustainable development principles have been slower to develop. Environmental health services have a pivotal role taking up this challenge.

### *The precautionary principle*

The precautionary principle deals with situations in which science and technology cannot provide a full response to issues, leaving a degree of uncertainty in terms of the effects of certain activities, technologies and products. The general thrust of this principle might be expressed as "where there are sufficient grounds for believing that an activity or a product is likely to cause threat of serious and irreversible damage to health or the environment, measures must be taken to reduce or prevent that activity or product, even if there is no fully conclusive evidence of a causal link between that activity or product and the feared consequences" *(18)*.

Environmental health services have an important role to play as advocates of this principle, as partners in the guardianship of its implementation, and as proactive communicators of its implications to policy-makers, the economic sectors and society at large.

## PATHWAYS INTO THE FIELD OF ENVIRONMENTAL HEALTH

An explanation of the term "environmental health professional" is crucial to any meaningful discussion on appropriate curricula.

In a survey on this question, the Regional Office drew up a list of no fewer than 31 different categories of professional identified by a sample of the Member States themselves as being involved in areas related to environmental health. Through further research and consultations *(19)*, the Regional Office has since developed a considerably larger list (Box 1). This list provides a valuable insight into "environmental health" as a concept, a discipline and a field. Given the evolving nature of environmental health, it is perhaps advisable to consider the limits of this field in terms of horizons rather than boundaries.

### Box 1. Professions involved in environmental health

Academics, lecturers, teachers, teacher trainers
Agriculturists
Agronomists
Architects
Bacteriologists
Biochemists
Chemical process engineers
Civil engineers
Climatologists
Communications experts
Disaster preparedness specialists
Ecologists
Economists
Engineering specialists (with postgraduate qualifications)
Entomologists
Environmental biologists
Environmental chemists
Environmental engineers
Environmental health administrators
Environmental health educators
Environmental health managers
Environmental health officers
Environmental health planners
Environmental health technicians
Environmental lawyers
Epidemiologists (with medical degree)
Epidemiologists (without medical degree)
Ergonomists
Fire safety officers
Food inspectors
Food safety specialists
Geneticists
Geographers
Geologists
Health promotion experts
Hydrogeologists
Hydrologists
Hygienists
Information scientists
Laboratory assistants/technicians
Marine scientists
Materials technologists
Medical specialists (with postgraduate qualifications in the public health area)
Meteorologists
Microbiologists
Noise inspectors
Nuclear safety managers
Nutritionists
Occupational health nurses
Occupational health physicians
Occupational hygienists
Physicists
Political scientists
Pollution inspectors
Psychologists
Public health nurses
Public health physicians
Public health veterinarians
Public relations experts
Risk assessors
Rural and urban planners
Safety inspectors
Sanitary engineers
Sanitary officers
Social scientists
Social workers
Soil scientists
Statisticians
Technical assistants
Toxicologists
Transport planners/managers
Water quality inspectors
Zoologists

Not all of the professionals mentioned in Box 1 are to be found in every Member State, nor do all of the professions mentioned have an equal role in delivering environmental health services. Furthermore, many professionals listed might not consider themselves to be "environmental health professionals", nor would they describe the organizations or structures within which they work as "environmental health services".

What the list does demonstrate is the diversity of stakeholders involved in environmental health. This diversity encompasses not only these professionals but also, by implication, the educational institutions involved in their formative and continuing education, their employers and their professional representative groups.

The list also illustrates the point that many of the professionals in the field of environmental health may be found in both the private and the public sectors *(1)*.

Having examined the range of professional disciplines involved in many aspects of environmental health, it becomes clear that developing relevant curricula for each individual group would be an extremely difficult task, not least because of the varied roles of comparable professionals in Member States. The heterogeneous nature of professions, functions and tasks has been discussed in previous WHO consultations. The results of these discussions indicate that the various professionals enter the field of environmental health by a variety of routes.

First, there are those who have been educated and trained specifically as environmental health specialists, and operate in the environmental health field in a variety of roles and functions. Second, there are also those groups who have been trained as generalists or specialists in other disciplines, such as medicine, law or engineering, and who subsequently undergo further education or in-service professional development to achieve competence in environmental health issues. Third, there are groups of other professionals who, having risen through the hierarchy within their given sectors, become involved in the managerial and policy development aspects of environmental health services as part of their broadened scope of responsibility. In the case of the two latter groups, these professionals may subsequently work on environmental health issues either full- or part-time.

It is clear that all environmental health professionals do not enter or operate within environmental health services at the same level. There are obvious differences, both among and between the various professional disciplines, in terms of the type and level of expertise required, as well as the level in the structure of a national environmental health service at which such professionals might typically operate.

While overgeneralization is inappropriate, on the basis of the consultations carried out it is reasonable to assume that professionals working in the environmental health field can be grouped into three categories:

- environmental health technicians/aides
- generalist/specialist environmental health professionals
- environmental health managers.

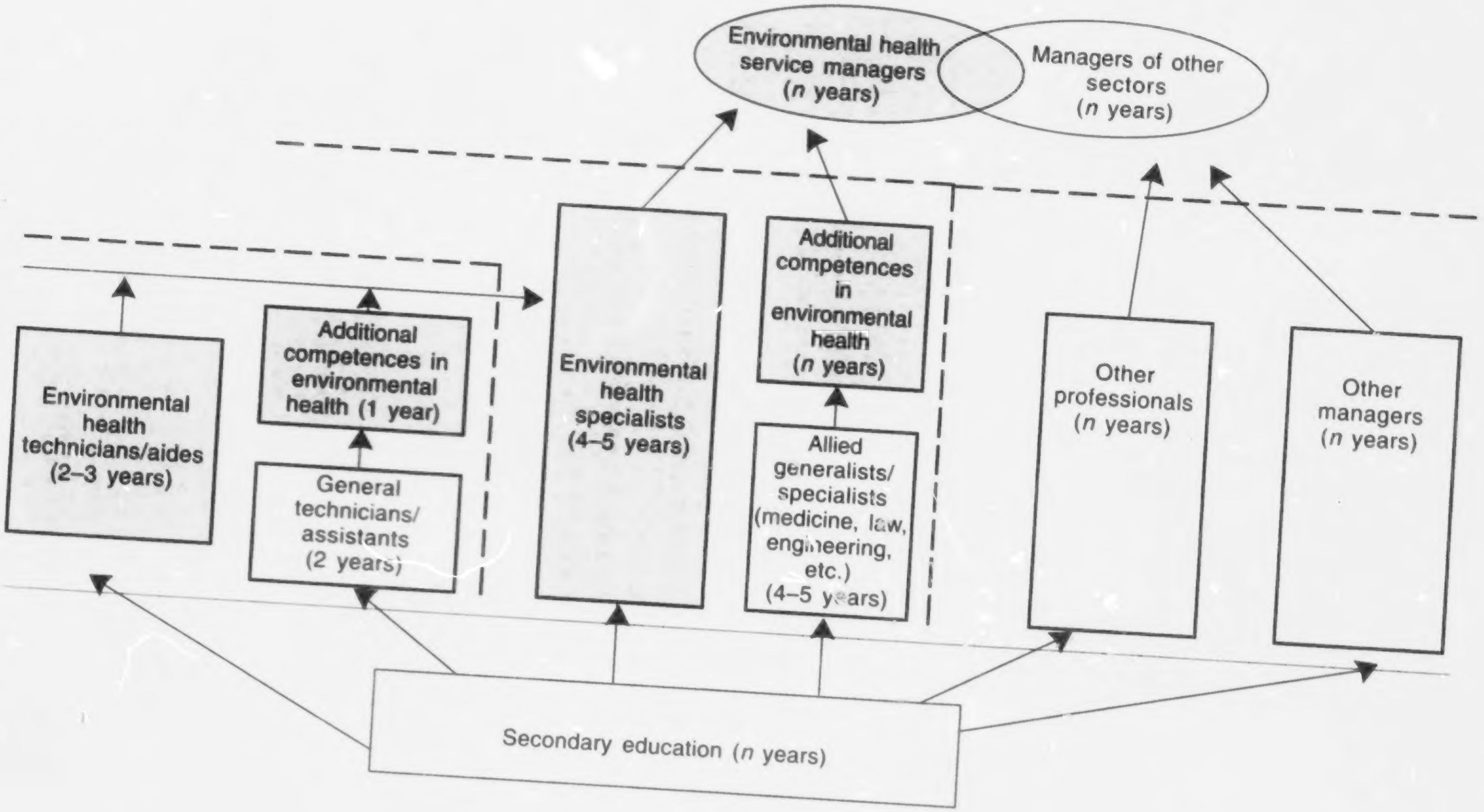
The pathways followed by these groups are shown in Fig. 1, together with the number of years typically spent in education in order to reach each level. The shaded areas show the range of environmental health professionals.

As can be seen from Fig. 1, those professionals who operate as environmental health technicians/aides either train specifically as such, or obtain further competence through additional training or education. Similarly, the specialist environmental health professionals enter the field having either trained as such or through additional training, education or perhaps research. Those in management positions either advance to these positions as environmental health specialists or become involved in environmental health issues as managers in other disciplines.

## DEVELOPING EDUCATIONAL CURRICULA

The main aim of this book is to provide guidance on curricula for environmental health professionals. The development of such

Fig. 1. Career pathways for professionals working in environmental health


Environmental health service managers (*n* years)
Managers of other sectors (*n* years)
Environmental health technicians/aides (2–3 years)
Additional competences in environmental health (1 year)
General technicians/ assistants (2 years)
Environmental health specialists (4–5 years)
Additional competences in environmental health (*n* years)
Allied generalists/ specialists (medicine, law, engineering, etc.) (4–5 years)
Other professionals (*n* years)
Other managers (*n* years)
Secondary education (*n* years)

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curricula, however, must occur within the context of the overall upgrading of education and training programmes for environmental health professionals.

There is an extensive body of literature on the development of education and training programmes generally, as well as specifically for health and environmental health. While it is not intended to review these sources here, it may be useful to introduce some of the terms and concepts that will be used throughout this book, and to explain the approach that has been adopted in developing these guidelines. This approach is based on generally accepted models of educational theory and practice. As a starting point, "curriculum" is taken to mean "the planned organization of a group of related educational activities" *(20)*.

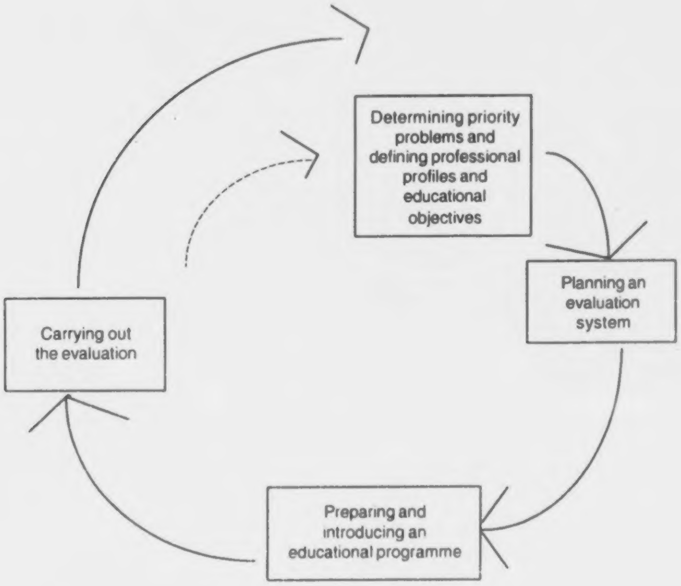
As stated above, the development of curricula is just one component of planning and conducting overall educational programmes. The development of such a programme might be characterized by four main tasks:

1. deciding on learning objectives (see Chapter 1 for a fuller discussion) appropriate to national environmental health priorities and needs;
2. selecting learning experiences that will contribute to achieving these objectives;
3. organizing these learning experiences to maximize their cumulative effect; and
4. evaluating the effectiveness of the education programme in attaining its objectives.

The development of educational programmes is best considered a continuing exercise, whereby the information and experience gathered is utilized to evaluate and further refine the programme as needed. This experience is also valuable in the subsequent development of new or related education programmes. The "education spiral" (Fig. 2) is widely used to illustrate this process *(20)*.

A crucial element of all environmental health education and training programmes is ensuring their relevance to the needs of the society they serve. The identification of a society's environmental

**Fig. 2. The education spiral**


Determining priority problems and defining professional profiles and educational objectives
Planning an evaluation system
Preparing and introducing an educational programme
Carrying out the evaluation

*Source*: Oshaug et al. *(20)*.

health-related needs, the formulation of policies to address those needs, and the mobilization of human and other resources to implement those policies is a complex process. Achieving this will require the involvement of a wide range of stakeholders; it cannot be done in isolation by an educational institution. The implementation of the tasks identified above for the development of an educational programme must therefore be viewed in terms of the existing environmental health policy framework. The relative position of educational institutions in this framework is illustrated in Fig. 3.

## METHODOLOGY

The essential elements of curriculum development are generally taken to include the following.

- Each course or programme should have stated objectives clearly indicating the purpose of the course.

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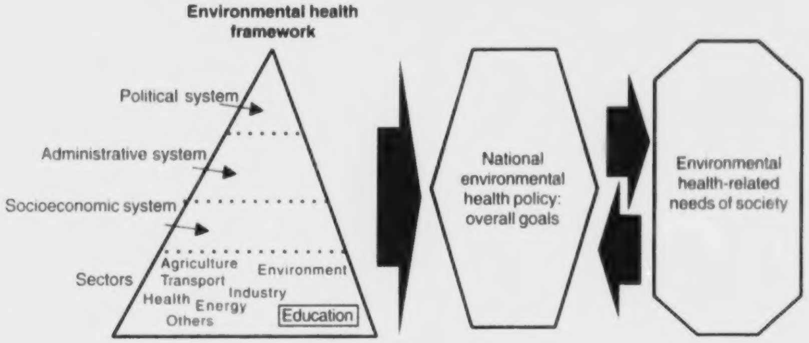
**Fig. 3. Framework for developing environmental health policy**


Environmental health framework
Political system
Administrative system
Socioeconomic system
Sectors
Agriculture
Transport
Health
Energy
Others
Industry
Environment
Education
National environmental health policy: overall goals
Environmental health-related needs of society

- The background knowledge necessary to benefit from the course should be stated in listed prerequisites. Where exemptions are allowed, the conditions for these should be clear.

- The approaches and methodologies most appropriate to achieving the stated learning objective should be explicit.

- The content and timetabling of the curriculum must be developed with regard to the teaching methodologies, in order to ensure there is sufficient time to deal with all subjects adequately.

- Evaluation of the course, the educational progress of students, and the teaching staff are all essential elements of curriculum development.

- Readily available and internationally authoritative publications should be used.

# 1

# Learning Objectives

## DEFINITIONS AND TERMINOLOGY

The purpose of this chapter is to discuss the development of learning objectives for educational programmes in environmental health. Oshaug et al. *(16)* discuss these issues in some detail and their findings are used extensively throughout this document.

Educational objectives are, in essence, what participants in an educational programme should be able to know, understand and do at the end of a learning period. They are also referred to as "learning objectives" as opposed to "teaching objectives", in order to emphasize that they define what the learner, not the teacher, should be able to know, understand and do.

The formulation of learning objectives for educational courses in environmental health must be closely linked to the environmental health needs of the society, to national and international policies on environmental health, and to the specific roles that environmental health professionals perform. The overall emphasis is on ensuring relevance between the objectives set and the needs of society that they address. Learning objectives should set out clearly:

- what the learner should be able to do at the end of the learning period;

- the conditions under which the learner should be able to perform the task; and
- the standard to which the learner should be able to perform.

Learning objectives may be general, intermediate or specific. General learning objectives describe in general terms the competences that learners are expected to have at the end of an educational programme in order to perform the specific *functions* of their categories of environmental health professional.

Intermediate learning objectives express in less general terms the competences that environmental health professionals are expected to possess at a certain stage of the educational process in order to perform certain required *activities*, or to continue their education and training. The sum of these activities defines the functions referred to above.

Specific learning objectives describe the *task* the learner is expected to be able to perform, or the behaviour expected, as a result of a specific unit of teaching and/or learning.

## WHY DEVELOP EDUCATIONAL OBJECTIVES?

Educational and training programmes have more of a chance of being effective if the overall objectives of that programme are clearly expressed. In the absence of clear objectives, it is not possible accurately to evaluate the effectiveness of such a programme. Nevertheless, learning objectives not only facilitate the effectiveness but, just as importantly, the relevance of educational programmes. To be relevant, educational programmes must be selectively shaped in terms of the aims to be achieved rather than being the result of non-selective mass of knowledge accumulated over time. Modifications to these aims must accordingly be reflected in modifications to the programme. The setting of learning objectives has specific benefits both to society as a whole and to educational institutions.

### Benefits to society

- Suitably competent, highly motivated environmental health professionals can be trained, who can fulfil functions, carry out activities and perform tasks relevant to the needs of the society they serve.

- The consumers of the services such professionals provide can be protected, by ensuring that only those who have demonstrated an acceptable level of performance will be eligible to provide the types of service for which they were trained.

- Human resources for environmental health services can be provided more effectively and systematically, especially if service planners are aware in advance of the capacities of graduates of different educational programmes. On the other hand, educational planners need to be aware of the evolving needs of society, and what the environmental health services need to do to address those needs, in order to develop relevant learning objectives.

- Ongoing evaluation of national and subnational environmental health needs can be carried out.

### Benefits to educational institutions

There are obvious benefits to all those involved, both within and outside educational institutions (managers, teachers, students, professionals, employers, etc.) in terms of self-evaluation, evaluation of others and evaluation of the educational programme.

## DEVELOPING LEARNING OBJECTIVES

In developing learning objectives, three important considerations must be borne in mind:

- selection of the decision-makers who will decide on the learning objectives, a process that should include all the relevant actors (professionals, academics, teachers, students, etc.) on the basis of their background, professional affiliation, competence and involvement;

- the quality of information available on environmental health status and needs, financial support, functioning of environmental health services, educational problems, and the characteristics of learners and teachers; and

- the decision-making process for the management of education and human resources, which calls for attention to the timeframe, the steps to be taken and the results expected.

Annex G provides guidelines for the development and evaluation of learning objectives for educational programmes for environmental health.

## THE MISSION OF ENVIRONMENTAL HEALTH SERVICES

To develop the relevant learning objectives for environmental health professionals, it is necessary to formulate an overview of the current and envisaged objectives, functions, activities and tasks of the various categories of environmental health service. These issues are the subject of the companion volume to this book *(1)*, which also identifies the various core areas of environmental health as set out in *Health for all targets (5)*, the Environmental Health Action Plan for Europe *(14)*, *Concern for Europe's tomorrow (21)*, and elsewhere.

The Environmental Health Action Plan for Europe provides a framework for setting the necessary objectives, and the actions and interventions to be carried out by Member States in a wide range of sectors. These objectives and actions are categorized in accordance with a range of criteria that include the nature and extent of the environmental health hazard, evidence of a worsening trend, the technical feasibility and affordability of solutions, and the likely health benefits to be accrued. A full discussion of these objectives is also provided in the companion volume *(1)*.

## CORE AREAS OF ENVIRONMENTAL HEALTH

Given the divergence in the current understanding of "environmental health" and "environmental health services", it is important first to identify the core areas of concern for an environmental health service. These have been described in the companion volume, and are set out in Box 2.

**Box 2. Core areas of environmental health**

Environmental health policy
Environmental health management
Accident and injury prevention and control
Water quality
Air quality
Food quality and safety
Waste management and soil pollution
Human ecology and settlements
Health of people at work
Energy
Transport management
Land-use planning
Agriculture
Ionizing and nonionizing radiation
Noise control
Tourism and recreational activities
Vector control

## FUNCTIONS OF ENVIRONMENTAL HEALTH SERVICES

For the purposes of this book, the functions that an environmental health service might carry out in each of the core areas shown in Box 2 are discussed under the following rubrics:

- risk assessment
- risk management
- risk communication
- intersectoral cooperation and consultation
- education and training
- research.

### Risk assessment

The National Academy of Sciences in the United States *(22)* has defined risk assessment as "the characterization of the potential adverse effects of human exposures to environmental hazards".

Risk is traditionally viewed as a function of exposure or dose, expressing the probability that an adverse outcome will occur in a person or a group exposed to a particular concentration or dose of a hazardous chemical, biological or physical agent. There is now a growing realization that risk assessment must also take account of social and economic issues, and that "risk" may occur as a result of exposure to a wide range of socioeconomic conditions *(2)*.

Risk assessment is used to address the following questions.

- Is exposure to the agent/factor a potential hazard to human health?
- What relationship exists between exposure to the agent/factor and risk to health?
- What is the extent of exposure to the agent/factor in the population?
- What is the magnitude of the public health problem?

Risk assessment also includes characterizing the uncertainties in the process of determining risk, and in gaining an understanding of risk as perceived by in exposed individuals or groups.

### Risk management

Risk management involves integrating the results of risk assessment with engineering data and social, economic and political considerations, weighing policy alternatives, and selecting an appropriate course of action. This process involves evaluating the various actions directed at reducing the health risk and then selecting, promoting and implementing the appropriate alternatives. This selection is the synthesis of the scientific information gathered in the course of risk assessment, coupled with the social, economic and political judgements that influence decisions on the control of environmental health hazards *(23)*.

### Risk communication

Risk assessment and management processes must remain cognizant of the stakeholders who ultimately use environmental health information. These include government and regulatory authorities, industry, land owners and occupiers, the general public, professional groups and special interest groups. Risk communication involves developing and promoting dialogue among these stakeholders.

Effective risk communication depends on a three-dimensional matrix of characteristics describing the magnitude of the risk, the degree of knowledge or uncertainty about the process and magnitude of risk involved, and the nature of the risk both in its natural context and as perceived by the different parties in the communication process *(24)*.

### Intersectoral cooperation and consultation

Responsibility for protecting and improving environmental health lies not only with those responsible for the environment and health sectors, but with society as a whole and particularly with the industry, energy, transport, agriculture and tourism sectors. Environmental health services have the crucial task of ensuring that a holistic approach to environment health hazards and risks is maintained. This is an integral part of risk management, but in practice, it is often neglected. It is dealt with here separately so that specific issues involved may be highlighted.

### Training and education

Training may be described as the acquisition of specific task-orientated skills and knowledge. In many cases, training has a wide range of potential target audiences, including industry and certain professional and technical occupations. Environmental health services are concerned not only with developing the capacities of professionals within their own ranks, but also with sharing this knowledge with those in other sectors.

A supply of well educated, highly motivated graduates and trained professionals who will be the leaders and service managers of the future is essential to the viability of any profession or service. To develop sustainable structures, therefore, environmental health services must be involved in the education and training of these professionals.

The needs of those professionals currently working in environmental health services must also be addressed, and the services that employ them have particular activities and tasks to perform in promoting continuous professional development.

### Research

Research has supplied the knowledge and understanding behind the greatest victories in the fight against disease, disability and death *(25)*. In relation to environmental health, there are research activities and tasks to be carried out on a number of fronts. Basic research is needed on health hazards in the environment, their causes and the possible means of their prevention. Increasing emphasis is being placed at present on the interaction of low-dose and long-term exposures to agents and combined exposure to various risk factors. Research is also required in a host of other fields, however, including the socioeconomic aspects of environmental health management, environmental health risk communication and equity in health.

The pooling and exchange of research information is also an increasingly important area of concern, and making this information available and understandable to stakeholders is closely linked to the risk assessment–management–communication continuum.

## ACTIVITIES OF ENVIRONMENTAL HEALTH SERVICES

The companion volume to this book *(1)* deals in detail with possible activities for environmental health services in all the abovementioned core areas of environmental health. A perusal of these will indicate that there are many areas of common activity across each of the relevant core areas. These common activities are reproduced below.

### Common risk assessment activities

Environmental health services identify potentially hazardous biological, chemical, physical or other factors or agents present in or likely to enter the environment, and assess the potential or actual effect of such factors or agents on human health. They compare observed levels with recognized standards or the best available information, and determine the relationship between environmental exposure and effects on health.

The exposure of individuals and populations is assessed in relation to recognized standards or the best available information, and the results of sampling and analyses programmes fed into the decision-making process. The behavioural and socioeconomic patterns underlying risk of exposure must be studied and high-risk behaviour and practices identified, and the social, economic and geographical distribution of high-risk groups must be determined. The environmental health impact of new developments on the community is assessed, and the social and economic costs and benefits of policies and practices are determined.

The environmental health services also deal with enquiries and complaints from the general public, and monitor and control the movement of materials across national and international boundaries.

## Common risk management activities

The risk management activities of environmental health services include the development of:

- a policy framework for protecting environmental health in the community;
- integrated approaches with key partners in drawing up national development plans;
- economic instruments for the promotion of sustainable technologies and patterns of behaviour;
- environmental health promotion programmes;
- codes of practice and protocols for environmental protection;
- monitoring and surveillance systems to ensure compliance with mandatory standards and codes;
- a framework and protocols for appropriate self-monitoring and control by economic sectors; and
- community-based strategies to protect the most vulnerable groups.

The services formulate proposals on standards and codes for exposure limits to potentially hazardous microorganisms and chemical and physical agents, and initiate legal and/or economic sanctions as appropriate for noncompliance with legal standards. They notify and register occurrences of disease related to environmental conditions, participate in the development of codes of practice and standards for promoting sustainable development, and ensure the provision of appropriate levels of treatment for basic amenities such as drinking-water. They instigate the implementation of remedial strategies, projects and measures as necessary, collaborate in the accreditation of environmental health laboratories and services as appropriate, and participate in the formulation and implementation of contingency plans. Finally, environmental health services must deal with enquiries and complaints from the general public.

## Common risk communication activities

In the field of risk communication, environmental health services:

1. provide stakeholders with information on the risks associated with potentially hazardous environmental agents;
2. develop public awareness and education programmes (see also the section below on education and training);

3. liaise with the mass-media to provide accurate information to the public;
4. provide information to high-risk groups;
5. develop information systems for the sharing of data with stakeholders;
6. identify stakeholders with whom lines of communication must be fostered;
7. promote the economic and social benefits of sustainable development strategies;
8. collaborate in the development of early warning systems of natural and man-made disasters;
9. provide information, guidance and reassurance in the event of an emergency;
10. promote public participation in the development of environmental health policy;
11. promote voluntary compliance with legal standards and norms;
12. promote informed discussion on the consequences of decisions taken; and
13. develop mechanism and forums for the dissemination of information to the public and for the identification of policy options in collaboration with stakeholders.

### Common intersectoral cooperation and consultation activities

Environmental health services identify key stakeholders in allied sectors with responsibilities in the environmental health field, collaborate with those sectors in developing appropriate economic and legal instruments and in contingency planning, and develop with them a framework for dealing with issues affecting multiple core areas of environmental health. (exposure to lead contamination being a prime example). They develop mechanisms for collaboration with the community and nongovernmental organizations, integrated policy and planning mechanism with allied sectors, and integrated policies for the coordination of resources. They also liaise and negotiate with international partners.

### Common education and training activities

Environmental health services develop specific programmes for training trainers in environmental health issues, and collaborate in:

- the development, design and delivery of environmental health education and training programmes for graduate environmental health professionals, together with educational institutions, professional organizations and other stakeholders;
- the development and implementation of educational programmes for continuous training and professional development of current environmental health professionals;
- the development of appropriate educational and training programmes on environmental health issues for professionals and workers in allied sectors;
- the development, with other sectors, of educational and public awareness campaigns on environmental health issues (see also the section above on risk communication); and
- the accreditation and evaluation of education and training courses for environmental health professionals.

### Common research activities

In the research field, the services study the socioeconomic factors underlying the status of health and the environment, and investigate long-term health affects of environmental agents and the psychosocial factors contributing to environmental health status. They also study new technologies for reducing environmental pollution, innovative methods for monitoring pollutants, and the economic effects of policies on the environmental health and allied sectors. They initiate epidemiological studies to determine the relationship between exposure and health risk, and carry out comparative studies of high-risk groups within the general population.

## ENVIRONMENTAL HEALTH COMPETENCE

As stated above, learning objectives are designed to set out what a student should know, understand and be able to do. In the case of environmental health professionals, these should address the functions, activities and tasks of environmental health services. The term "competent" can be used to describe a high degree of proficiency in working towards these objectives, and participation in carrying out the various functions, activities and tasks.

There is frequently confusion over the use of the term "competence". Similarly, terms such as "knowledge" and "skills" are often used interchangeably, whereas in fact they have specific meanings in an educational context. Competence involves a three-stranded concept incorporating various aspects of human intellect, namely the relevant attitudes, knowledge and skills.

Professional competence is defined as "the ability to carry out a certain professional function, which is made up of a repertoire of professional practices. Competence requires knowledge, appropriate attitudes and observable mechanical and/or intellectual skills, which together account for the ability to deliver a specified professional service" *(26)*.

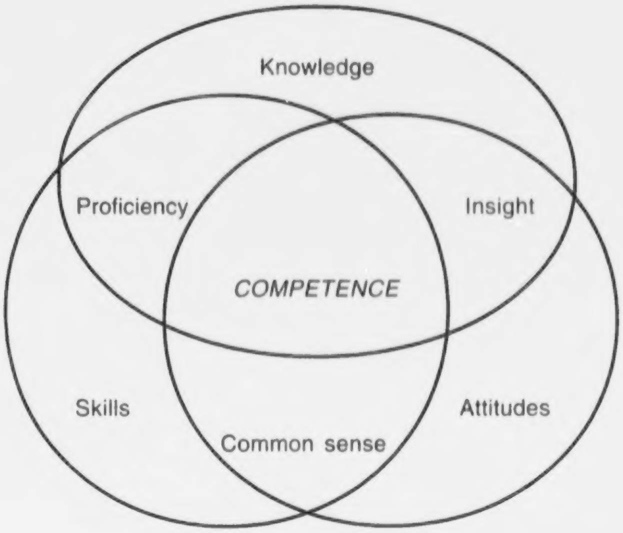
Attitudes indicate the behaviour a professional should practise. These attitudes may be defined as "the predisposition to perceive, feel or behave in a particular manner...". Knowledge is the theoretical knowledge a professional must acquire, and may defined as "the collection of facts, values, information etc. to which one has access through study, intuition, or experience". Skills indicate the ability to carry out a specific task and may be defined as the "systematic and coordinated pattern of mental and/or physical activity" *(26)*.

"Competent" may refer to or describe individuals, groups or organizations exhibiting or possessing competence. "Competence" may be used, in the generic sense, to refer to areas of knowledge, skills and attitudes.

Fig. 4 shows the relationships between these various domains, and suggests some terms that might be used to describe areas of overlap between the domains.

Environmental health professionals, regardless of the wide range of disciplines from which they are drawn or the variety of tasks they perform, should possess some common areas of competence. The range and depth of competence needed by environmental professionals to work at different levels will obviously vary with the nature of their role, the degree of responsibility involved, and specific organizational functions. While such professionals may work at all levels in the public and private sectors, it is important that there is a

**Fig. 4. Domains of human intellect that contribute to competence**



common theme unifying them in dealing with environmental health issues.

## The domain of attitudes

Attitudes form the basis on which environmental health professionals perform their duties. It is this framework of values that provides a strong unifying theme between professionals at all levels in the environmental health field.

Personal, social and cultural beliefs will have a major role in the development of professional values. The beliefs, values and needs of a society will, in many instances, dictate the manner in which that society addresses those needs. For environmental health professionals, the challenge is to address these issues in a manner that balances these social, economic, political and cultural factors.

The attitudinal competence needed has been explored in detail by various groups of environmental health professionals. In many cases these have been developed by cadres of professionals developing codes of conduct necessary for them to carry out their duties, and to serve their communities properly. This has often been prompted by groups of like-minded professionals recognizing that there is much merit in actively developing their own guidelines on professional conduct rather than having them imposed from outside.

Examination of these codes shows that there are broad common themes in terms of the attitudes identified *(27–31)*. Proposed basic areas of attitudinal competence required of environmental health professionals are given in Box 3.

**Box 3. Basic areas of attitudinal competence**

Caring attitude towards people
Active concern for public health
Personal conviction of the need for a safe and healthy environment
Willingness to work with and/or lead others as part of a team
Mutual respect for and appreciation of the roles of other disciplines
Ability to recognize the point at which a problem requires expertise of other professionals
Honesty in situations where answers or solutions are not known
Desire to learn independently
Commitment to strive for personal development
Ability to deal with uncertainty
Ability to develop and modify thinking in the light of experience
Personal and collective integrity
Open-mindedness, objectivity and awareness of one's own prejudices
Role model in espousing healthy and environmentally friendly lifestyles
Sense of belonging to and pride in one's chosen profession
Enthusiasm and diligence in one's chosen career
Commitment to democratic principles and human rights
Commitment to health for all principles
Perseverance and commitment in dealing with issues
Willingness to take a principled stand on issues of public concern
Willingness to reach an honourable compromise on issues
Respect for the need for appropriate levels of confidentiality
Willingness to accept responsibility and be accountable for one's actions

## The domain of knowledge

Knowledge has previously been defined as "the collection of facts, values, information etc. to which one has access through study, research, intuition, or experience" *(26)*. For most professionals, their education and training are based on developing theoretical knowledge augmented by training in practical skills. The acquisition of competence in one domain leads to understanding and insight into competence in the other domain. It is evident that there are many similar activities and tasks to be performed in each of the core areas of environmental health identified earlier, and that there are also common pools of knowledge necessary to carry these out.

The Frankfurt *(7)*, Rio *(9)* and Helsinki *(13)* initiatives fundamentally changed the understanding of and approaches to environmental health. In the light of this new understanding, the relevant disciplines covering the field of environmental health have broadened considerably.

As can readily be seen from Box 4, environmental health is a truly interdisciplinary field; no one individual, discipline or group of professionals could possibly aspire to being expert in all of these areas of knowledge. Nevertheless, environmental health might also be considered a discipline in its own right, a discipline based on the advocacy of a holistic and integrated philosophy for addressing the interrelationship between environmental issues and the various aspects of human health. This philosophy, based on the principles set out in the Introduction, cannot be adequately covered by any of the disciplines given in Box 4.

**Box 4. Disciplines covering the field of environmental health**

- Agriculture
- Biochemistry
- Biology
- Biotechnology
- Built environment
- Business management
- Chemistry
- Earth and environmental sciences
- Ecology
- Economics
- Education
- Engineering
- Epidemiology
- Evaluation sciences
- General toxicology
- Genetics
- Human resources management
- Hygiene
- Immunology
- Information and communication sciences
- Law
- Linguistics
- Management sciences
- Mathematics
- Meteorology
- Microbiology
- Molecular biology
- Occupational medicine
- Pathology
- Physics
- Physiology
- Political sciences
- Psychology
- Social sciences
- Statistics
- Urban planning
- Veterinary science
- Zoology

## *Knowledge required in risk assessment*

The common pool of knowledge required for effective risk assessment is shown in Box 5. One of these disciplines deserving particular mention is epidemiology. This involves the study of the distribution and determinants of health-related states or events in specified populations and the application of its findings for the prevention or

**Box 5. Common pool of the knowledge required for effective risk assessment**

Applied biology
Applied mathematics
Applied physics
Behavioural Science
Biomonitoring
Ecology
Environmental chemistry and biochemistry
Environmental health economics
Environmental health impact assessment
Environmental health law
Environmental health policy
Epidemiology
Information science
Linguistics
Medicine
Microbiology
Organizational and human resource management
Pathology
Physiology
Risk assessment management
Social science
Toxicology

control of health problems. As such, it is a fundamental component of well developed health programmes and the basic quantitative science of public health research and practice *(32)*.

More specifically, environmental epidemiology is concerned with the adverse health effects provoked or exacerbated by environmental factors. Such factors are inclusive of psychosocial conditions relating to housing, unemployment, educational level, poverty and cultural issues.

The multidisciplinary nature of environmental epidemiology is reflected in the variety of specialized scientific disciplines it incorporates. The areas of knowledge should include:

- biological and physical sciences such as toxicology, radiation biology, clinical medicine and chemistry;
- engineering sciences such as sanitary engineering, industrial hygiene, hydrology meteorology, ventilation engineering and acoustics;
- social sciences such as demography and sociology
- economic sciences; and
- mathematics and applied statistics.

Specific applied knowledge necessary in environmental epidemiology includes *(33)*:

- an understanding of epidemiological principles as they apply to the field of environmental health;
- an understanding of the adverse health effects of various chemical, physical and biological risk factors;
- an understanding of the concept of exposure routes and issues related to measuring environmental exposures;
- the ability to design and carry out epidemiological studies;
- the ability to assess, validate and analyse data;
- an understanding and appreciation of how to utilize epidemiological data in developing prevention and control strategies; and
- an understanding of risk management and communication.

In addition to this common pool of knowledge, there are other specific fields of knowledge that have particular relevance to each of the core areas of environmental health (Table 1).

## Knowledge required in risk management

The areas of knowledge required for effective risk management are quite broad and include the following:

- organizational management
- socioeconomic management
- problem solving and decision-making
- information management
- human resource management
- legal and legislative knowledge.

### Organizational management

The range of competences in organizational management encompasses policy, development, strategic and contingency planning, applied management sciences and evaluation of services.

### Problem-solving and decision-making

*Concern for Europe's tomorrow (21)* identifies the development of competences in this area as an absolute priority for many Member States in the European Region. The development of such competences plays a vital role in identifying, quantifying and prioritizing issues of concern. Equally importantly, competence in this area includes planning, implementing *and* evaluating strategies and measures to address environmental health issues.

**Table 1. Fields of knowledge relevant to the core areas of environmental health**

| Core Area | Field of knowledge |
|---|---|
| Accidents | Predictive modelling of accident scenarios<br>Contingency and logistical management<br>Accident perception and psychology<br>Accident and risk economics |
| Water quality | Water and wastewater chemistry<br>Applied hydrology<br>Hydrogeology<br>Marine sciences<br>Hydromechanics<br>Water-supply and wastewater treatment technologies<br>Agricultural, industrial and energy management |
| Air quality | Climatology<br>Industrial and energy management<br>Meteorology<br>Atmospheric chemistry<br>Atmospheric and climatological modelling |
| Food quality and safety | Agricultural management economics<br>Veterinary science<br>Soil science<br>Food production technology<br>Hazard analysis systems (hazard analysis critical control points methodologies)<br>Health promotion skills<br>Biotechnology and genetic modification technology |
| Waste management and soil pollution | Solid and liquid waste management<br>Soil science<br>Contaminated land management and rehabilitation<br>Waste avoidance management |
| Human ecology and settlements | Construction management<br>Rural management<br>Architecture<br>Urban planning<br>Building and housing science |
| Health of people at work | Ergonomics<br>Occupational safety<br>Environmental protection<br>Engineering technology<br>Occupational hygiene<br>Biotechnology |

Table 1. (contd)

| Core Area | Field of knowledge |
|---|---|
| Energy | Energy consumption modelling and prediction<br>Long-distance monitoring and remote sensing techniques<br>Geographical information systems (GIS) |
| Transport management | Transport and logistics economics<br>Transport modelling |
| Motor engineering | Transport behavioural studies<br>Road safety studies |
| Land-use planning | Town and country planning<br>Open space management<br>Nature conservancy and wildlife protection<br>Contaminated land management<br>Agricultural management<br>Natural resource and energy management |
| Agriculture | Plant and crop sciences<br>Animal husbandry<br>Veterinary science<br>Chemical and pesticide safety<br>Marine and fishery sciences |
| Ionizing and nonionizing radiation | Natural background radiation monitoring and protection techniques<br>Nuclear power plant safety auditing<br>Nuclear waste management<br>Radiation monitoring<br>Predictive modelling techniques<br>Rehabilitation techniques for contaminated sites<br>Applied epidemiological skills for investigating exposure to nonionizing radiation sources |
| Noise control | Noise exposure assessment techniques<br>Noise-induced annoyance study skills<br>Community noise assessment |
| Tourism and recreational activities | Bathing water monitoring<br>Leisure facility control<br>Applied ecology<br>Littoral and estuarine sciences |
| Vector control | Entomology<br>Parasitology<br>Applied zoology<br>Infectious disease control techniques |

### Socioeconomic management

In *Concern for Europe's tomorrow* one of the fundamental concerns is "whether the economic environment, production and consumption are able and willing to support sustainable development". This challenge will be met in diverse ways by Member States acting both unilaterally and as part of the international community. The Environmental Health Action Plan for Europe *(14)* gives priority to the development of appropriate economic instruments to address many environmental health and sustainable development issues. In this context, there is a crucial need to develop competence in a wide range of social and economic fields within the environmental health services. There is also a need to establish strong intersectoral links to identify strategic allies who can also participate in contributing essential areas of competence to the policy-making process. The burgeoning of private economic sectors is a fact of life in all Member States in the European Region. In addition, the private–public sector relationship, the growing move towards deregulation in some countries, and forward planning of national and international economies are issues of concern for environmental health services.

The relevant fields of knowledge include (though not exclusively):

- economic evaluation
- economic planning and development
- environment and health economics
- ethics
- macroeconomics
- marketing
- microeconomics
- national and international economic policy
- organizational management
- sociology.

### Information management

A central pillar of modern management systems is the effective management of information. In terms of risk management, this means not simply acting as a passive conduit for the flow of information to and from various sources, but having the capacity to evaluate, assess and ensure the quality of information. This information must then be integrated into the policy- and decision-making process through various information systems and mechanisms.

### *Human resource management*

The profound changes in many countries of the European Region, particularly in the last decade have highlighted the necessity for having well trained, highly motivated environmental health professionals. The potential benefits of this resource of professional excellence will not be fully realized, however, unless the skills exist for their organization, delegation, motivation and evaluation. The need to develop competence is therefore a priority for the environmental health services at local, subnational and national levels. The areas of competence associated with this field of management include elements of those identified above for economic management, plus:

- employment relations management
- labour relations skills
- professional representation
- labour economics
- human resource development and training
- human resource research skills
- team-building/leadership skills
- communications skills (see also below under *Knowledge required in risk communication*).

### *Legal and legislative knowledge*

Regulatory and legislative measures underpin the policies and activities of environmental health services, and in a wider context all of the economic sectors. The development of competence in this area is a primary concern of environmental health services.

The range of such knowledge is very wide. In addition to scientific and technical expertise, the development of appropriate policy and legal frameworks must take account of economic, social and political factors, and responsiveness to the needs and expectations of interested parties is also important.

The scope of knowledge required includes the economic, political and social sciences, international diplomatic and legal matters, and scientific and technical competence.

## Knowledge required in risk communication

Environmental health services act as the direct interface between policymakers and those who are subject to that policy. The professionals in such services must routinely explain the degree of knowledge (or more often the degree of uncertainty) that exists about the processes and magnitude of risk surrounding specific environmental health issues.

Experience from large-scale incidents such as that at Chernobyl shows that their psychological effects can be more important than the direct effects of unplanned emissions. Equally, failure to communicate the full extent of a pollution episode or other risks can seriously compromise scientific and political credibility. Consequently, a basic requirement for all national and subnational authorities is gain the trust of the society they serve, and to ensure credibility in their dealings and pronouncements on environmental health issues. The areas of competence required to achieve this are to be found in part in each of the domains of attitudes, knowledge and skills.

The main fields in which knowledge of risk communication needs to be developed include:

- risk perception
- information management
- communication skills
- teaching and training.

### Risk perception

For those involved in risk communication, an understanding of risk perception on the part of exposed populations is vital. Similarly, the ability to explore, rationalize and understand individual and social attitudes to voluntary and involuntary environmental risks is also important. The pervasive influence of technology on societies, in social and psychosocial terms, and its relevance to environmental health also must be understood. This understanding can contribute significantly to ensuring social pressure and support for policies and laws that may be formulated subsequently.

### Information management

A fundamental understanding of statistical techniques, in order to evaluate and communicate scientific knowledge and exposure data, is crucial. The ability to facilitate the harmonization of criteria and standards for the collection and transmission of data on environment and health is equally important. Building competence in utilizing the various information media available must be an absolute priority in environmental health services. The potential of geographical information systems (GIS) as a tool for environmental health services in risk management and in risk communication has yet to be fully explored.

### *Communication skills*

Explaining the rationale behind the prioritization of risks is an important element of risk communication. The ability to explain situations to non-experts in scientifically sound, non-technical language requires a high standard of skills in communication. An ability to listen to and assess the concerns of the same people is equally important. The development of these skills can assist in obtaining the necessary public, political and social support for subsequent interventions.

A thorough knowledge of mediation and negotiation techniques can be utilized on a whole range of issues. Environmental health professionals have an important role as mediators and facilitators between different and often divergent interests. The competence required for this includes an understanding of the needs of the various economic sectors, the ability to advocate the need to protect and enhance the natural environment and public health, and the mediation skills necessary to find consensus between all the sectors involved.

### *Teaching and training*

All environmental health professionals must be able to teach and train, as there are numerous target audiences for appropriate educational activities. These include fellow professionals, those in the industrial or economic fields, policy-makers and the general public. In too many situations, professionals develop the mistaken belief that the ability to carry out a task is all that is required in order to pass on the requisite skills to another individual or group of individuals. In practice, teaching, the training of trainers and peer training require a high degree of competence (see page 29).

## Risk communication in accident and disaster situations

It is not an exaggeration to state that in dealing with accidents and disasters, effective risk communication can save lives. Apart from reducing the risk of fatalities, effective risk communication can have many other benefits, not least the development in all sectors of society of an ethos of safety based on an understanding and appreciation of the issues.

In the event or likelihood of accidents or disasters occurring, potentially exposed populations require timely, accurate and unambiguous information. In many instances this information will be disseminated through various types of mass media. The necessity to acquire specific competence for this task should not be underestimated. Effective communication skills that make the best use of the publishing and broadcasting media to explain scientifically complex issues to non-experts are becoming increasingly important to environmental health professionals. Similarly, being able to explain these issues to policy-makers who may be non-experts is also vital. These competences are naturally just as important in dealing with more routine situations, but the scale of this importance is particularly reflected in accident and emergency situations.

Given the transboundary nature of the effects of large-scale accidents and disasters, the ability to communicate information to professional colleagues, the international community and the media in appropriate languages is also an important consideration.

## Knowledge required for intersectoral cooperation and consultation

The achievement of sustainable development depends on the integration of health, environmental, demographic and economic development goals. To achieve this, intersectoral cooperation and consultation are absolutely essential. Environmental health services must play a proactive role in the promotion and realization of this aim. In practice, this is an integral element of the risk assessment–management–communication continuum.

Intersectoral cooperation and consultation in each of the core areas involves the environmental health services:

- identifying appropriate strategic partners in allied sectors;
- liaising and consulting on issues of common interest and concern;
- developing forums and mechanisms for collaboration with all interested parties;
- collaborating on the development of integrated policies and plans;
- developing the necessary legal and organizational frameworks to implement integrated policies;
- collaborating and participating in the implementation of interventions and activities; and
- collaborating in developing and implementing contingency plans.

The issues that must be regarded as both prerequisite competences in their own right and part of the process of developing intersectoral cooperation include:

- an understanding and appreciation of the activities carried out in other sectors and the role of other allied professionals in these sectors;
- an understanding of the significance each of these sectors has, and the contribution each can make, in the drive towards sustainable development;
- an awareness of the mutual costs and benefits that can emanate from adopting sustainable development strategies;
- an understanding of the consequence of, and a commitment to, sharing information and resources;
- the ability to work together in a coordinated manner on developing, implementing and evaluating integrated policies and plans; and
- the ability to develop a holistic overview of sectoral policies that take cognizance of the wider issues and the greater common good.

To achieve the level of integration and cooperation necessary, it is essential that environmental health professionals develop abilities in advocacy. Such skills are necessary in order to communicate these ideas to other professionals and policy-makers in allied sectors in terms that are both relevant and meaningful to them.

Contingency planning for accidents and disasters is one area where there is general support and understanding for the need to develop intersectoral cooperation and consultation. The lessons learned in this sphere over many years should be studied and made relevant to preventive and proactive interventions in environmental health management.

### *Knowledge required in education and training*

There are numerous target groups for education and training by professionals within the environmental health services. These include fellow professionals (including trainees, students and graduates), professionals in allied sectors, policy-makers, target occupational groups and the general public. The range of competences, and in particular the applied skills necessary, will be dictated by the target group involved.

Teachers and trainers must be able to empathize with, communicate with and stimulate the interest of their audience. It is ironic that many professionals who become involved in education and training are chosen on the basis of their research or professional abilities rather than their pedagogic abilities *(22)*. While many involved in teaching are outstanding in their professional disciplines, the ability to pass on knowledge and to sustain and reinforce students' motivation to learn are not always as well developed.

Specific areas of knowledge include :

- the capacity to stimulate interest but not to impose a view;
- the ability to pose questions in a non-directive manner;
- the willingness to work as team members in providing a balance of technical knowledge, practical experience and classical pedagogic skills that stress the responsibilities of those being taught;
- the ability to identify teaching methods and environments appropriate to the target audience, the material being taught and the desired outcome;
- the ability to assess and evaluate teaching programmes and their outcomes and to devise improvements or modifications as required;
- the ability to train other teachers and trainers in appropriate methodologies; and

- the ability to respond to the needs of specific target groups in terms of developing communication skills appropriate to their situation, examples being linguistic skills for dealing with migrant workers, refugees, etc.

There are many settings in which environmental health professionals may become involved in education and training activities. These will frequently be outside the formal educational structures or institutions. In fact, many environmental health professionals seek to use their contact with target audiences, in any context, as an open-ended educational opportunity. Specialized communication skills are necessary to gain the maximum benefits from this.

The ability to adapt education and training skills to the various communication media available is becoming increasingly important. Developing competence in this area greatly increases the opportunities available to environmental health professionals to maximize their teaching potential.

### Knowledge required in research

The importance of research in attaining WHO's European health for all targets can be gauged by the ensuing amount of attention that has been devoted to developing research policies in the European Region. The general competences necessary for research in pursuit of the health for all targets has been subsequently delineated *(34)* as:

- knowledge of qualitative and quantitative research methods;
- knowledge of research infrastructures at national and international levels;
- the ability to prepare scientifically sound and community-relevant research studies; and
- information and intellectual property management.

In terms of the competences required to ensure these policies succeed in the field of environmental health, such research must venture into fields that lie outside the traditional domain of health and the related sciences. This includes the biomedical, behavioural and social sciences, as well as engineering, land planning, urban planning, science and technology studies, telematics, communication science and others *(25)*.

### *Priority areas for developing research competence in environmental health*

Research competence needs to be developed in the continuing improvement of analytical chemistry, specifically with regard to low-level, long-term exposure hazards. Improved understanding of the long-term effects of accidents and disasters, in terms of both physical and psychological effects, is another area that merits attention.

The availability of advanced predictive modelling techniques, together with recent developments in telematics, has opened up a new field of research for environmental health workers. The development of competence in this area will become increasingly important. Involvement of expertise from the social and behavioural sciences is vital in developing research into, and the subsequent promotion of, community participation in environmental health.

The concept of sustainable development is relatively new to the international community, and research on the relevant strategies and policies will be a major focus of attention in the coming years. The competences necessary to develop this research will depend mainly on the ability to integrate information and data from widely diverse sources.

Finally, one vital area of competence previously proposed by WHO on this issue, which perhaps straddles the domains of attitudes, knowledge and skills, is expressed thus: "Researchers must also have the courage not only to recognize that no further information is needed … but to tell policy-makers that the time has come for action" *(35)*.

### *The domain of skills*

The skills needed by environmental health professionals cover a very wide range of areas and functions. They can be placed in six categories *(36)*.

1. Investigative skills include the ability to:

- design and implement tests, surveys and experiments;
- identify the range of information sources available; and
- gather information accurately by observation, interview, inspection, survey, examination, assay and research.

2. Analytical skills include the ability to:

- collate and sort data;
- identify relationships between data sets;
- critically examine data in terms of their consistency, reliability and validity; and
- organize and manage data.

3. Interpretative skills include the ability to:

- identify salient information;
- organize relevant information into logical, rational structures;
- draw inferences and make conclusions from available information;
- relate data to research findings and theory;
- explain the range of possible reasons for results of analysis;
- interpolate and extrapolate from given data; and
- evaluate, consider options and make decisions.

4. Communicative skills include the ability to:

- be articulate, rational and emphatic;
- be responsive to the needs of different target groups;
- develop listening skills; and
- use spoken and written language appropriate to different circumstances.

5. Educative skills include the ability to:

- utilize education as an integral component of an environmental health professional's work;
- positively influence the behaviour of others;
- combine effectively the various roles of an environmental health professional as adviser, educator and/or enforcer; and
- be aware of, and be ready to create and use opportunities for influencing, the behaviour of others.

6. Organizational skills include the ability to:

- organize one's own work and that of others as appropriate;

- effectively manage resources, including time, finances, equipment, information and people;
- set and strive towards management objectives;
- monitor results, assess performance and recommend further action as appropriate;
- see issues from a variety of standpoints;
- contribute to strategic long-term planning; and
- interpret, work within and evaluate an employer's overall strategy.

## PROPOSED LEARNING OBJECTIVES

### Environmental health technicians/aides

The proposed learning objectives for this professional group are:

- to understand the basic principles of the physical, chemical, biological and social sciences and be able to apply this understanding and knowledge to addressing environmental health problems;
- to be able to respond as a team member to environmental health concerns within society;
- to have the ability and motivation to update their knowledge and skills;
- to have experience of working in environmental health through guided professional practice;
- to have a basic understanding of the legal, governmental and administrative frameworks within which the environmental health system operates;
- to have an appreciation of the social sciences and be able to use this to understand the effect of environmental health issues on society and society's response to them;
- to be able to identify hazards and participate in the assessment and management of environmental health risk; and
- to numerate and able to apply and interpret the results of statistical analyses.

### Specialist environmental health professionals

The learning objectives for this group are:

- to understand the basic principles of the physical, chemical, biological and social sciences and be able to apply this understanding in identifying environmental health problems, both locally and globally, and a range of possible solutions;

- to be able to respond to environmental health concerns within society;
- to be able to identify hazards and to work with societal partners and others with appropriate expertise to assess and effectively manage the environmental health risk;
- to understand the social sciences and to be able to use this knowledge to understand and analyse the effect of environmental health issues on society and society's response to them;
- to have a comprehensive grasp of the legal, governmental and administrative frameworks at national and international levels within which the environmental health system operates, and to have an appreciation of the limitations and constraints that exist;
- to understand the interdependence and interrelationships between the scientific, technological, legal and administrative aspects of environmental health;
- to appreciate the restrictions placed upon environmental health investigations by political and socioeconomic considerations and by limitations of current knowledge;
- to develop interpersonal, organizational and problem-solving skills;
- to understand the inequalities that exist in society and the impact that behaviour, both personal and organizational, has upon others;
- to utilize the knowledge and skills acquired to identify and evaluate environmental health problems and a range of solutions;
- to understand the formulation and implementation of strategic policies relating to environmental health matters and to analyse the decision-making process and evaluate the impact and effectiveness of policies;
- to carry out research and to analyse environmental health problems, issues and documented findings;
- to appreciate the developing role of environmental health professionals in the promotion of public health and the importance of effective collaboration with other agencies, professionals and groups;
- to have the ability and motivation to update their knowledge and skills;

- to have a working knowledge of the duties of an environmental health professional through guided professional practice;
- to initiate and implement activities that promote an understanding of environmental health principles; and
- to be numerate and able to apply and interpret the results of statistical analyses.

## Environmental health service managers

Environmental health service managers should:

- be able to utilize expertise to direct the identification, assessment and management of environmental health problems;
- be able to be proactive in responding to environmental health needs within society;
- be able to identify and collaborate with societal partners in assessing and effectively managing environmental health risks;
- be able to collaborate in leading society's response to environmental health issues;
- have expertise in the legal, governmental and administrative frameworks at national and international levels within which the environmental health system operates;
- understand the interdependence and interrelationships between the scientific, technological, legal and administrative aspects of environmental health;
- understand the restrictions placed upon environmental health investigations by political and socioeconomic considerations and by limitations of current knowledge;
- develop strong interpersonal, organizational, team-leading and problem-solving skills;
- be familiar with the process formulating and implementing strategic policies relating to environmental health matters;
- be familiar with policy- and decision-making processes and the evaluation of policies;
- be able to lead research into environmental health problems;
- be able to facilitate the developing role of environmental health professionals in the promotion of public health and the importance of effective collaboration with other agencies, professionals and groups;
- have the ability and motivation to update their personal knowledge and skills and those of subordinates; and

- be able to initiate and implement activities that promote an understanding of environmental health principles.

## Managers of other sectors with specific responsibilities in the field of environmental health

These professionals should:

- be able to adapt their expertise to contribute to identifying, assessing and managing environmental health problems;
- appreciate the need to be proactive in responding to environmental health needs and leading the response within society;
- understand the mutual benefits that arise from the integration and mainstreaming of environmental heath issues into allied economic sectors, and the concept of sustainable development;
- be able to collaborate with societal partners to assess and effectively manage environmental health risks;
- have expertise in the legal, governmental and administrative frameworks at national and international levels within which the environmental health system operates;
- understand the interdependence and interrelationships between the scientific, technological, legal and administrative aspects of environmental health;
- be familiar with the process for the formulation and implementation of strategic policies relating to environmental health matters;
- be able to facilitate research into environmental health problems;
- be able to facilitate the developing role of environmental health professionals in the promotion of public health and the importance of effective collaboration with other agencies, professionals and groups; and
- have the ability and motivation to update their personal knowledge and skills and those of subordinates in environmental health issues.

# 2

# Approaches and Methodologies for Teaching Environmental Health

There is a wide variety of methodologies and approaches that may be utilized for imparting knowledge, and for developing skills and attitudes, among students of environmental health. The underlying philosophies behind these methodologies and approaches are well documented in educational literature, and will not be dealt with in detail here.

Current trends in this sphere stress the need to concentrate on the "teaching–learning system" rather than on teaching alone. Much criticism has been levelled at what has been termed the "communication–learning fallacy" which *assumes* that information translated to the student is always learned. Basic research in adult education has shown this is not always achieved. Adults tend to remember approximately 20% of what they hear, 40% of what they hear and see, and 80% of what they hear, see and do.

## RESOURCES FOR TEACHING ENVIRONMENTAL HEALTH

In many respects, the approaches and methodologies adopted in educational programmes depend on the resources accessible to educators. These include teaching staff and facilities (including premises, equipment and materials) library resources, documentation sources, support from professional groups or industry, and available time.

The World Health Organization is actively involved in assisting Member States in developing some of these resources through various initiatives. These include supporting the development of documentation centres and reference libraries at national and subnational levels within the framework of the WHO Global Strategy for Health and Environment *(37)*. This is intended to ensure that scientific and technical information on health and the environment becomes more widely and readily available. In collaboration with the United Nations Environment Programme, WHO has created the Global Health and Environment Library Network, which aims to facilitate effective and systematic provision of scientific and technical health and environment information to decision-makers, teachers, researchers, etc. In support of the library network, WHO has developed the health and environment library modules concept *(38)*, which consists in the establishment of a collection of the key scientific and technical information on health and environment issues available from other international organizations.

The Regional Office has also produced a wide range of publications on environment and health. WHO is also involved in the development of textbooks on the basics of environmental health for teachers and lecturers, and disseminates information on environmental health issues through electronic media such as the Internet.

## LOCATIONS AND OPPORTUNITIES FOR TEACHING ENVIRONMENTAL HEALTH

Traditionally, environmental health professionals have received their formative education, and much of their subsequent professional training, within the physical confines of educational institutions. While for most environmental health professionals this will continue during the course of their careers, there is a growing realization that the continuing educational needs of such professionals can be addressed in a variety of settings. The opportunities for developing education and training programmes has been greatly enhanced in recent years by adopting new technologies. The concept of a "university without walls" is well established in some Member States, and has operated very successfully for many years. These programmes incorporate such methodologies as distance learning, computer-aided education and electronic media, and provide flexible yet highly effective alternatives to traditional methods and approaches. It must be stressed that there is no single "correct" method or approach to teaching the various aspects of environmental health. What is important is that methodologies and approaches are adopted after a very careful evaluation of learning objectives, available resources and cultural and other factors.

The importance of incorporating learning and training opportunities into the work of environmental health professionals is also very important. These opportunities can be provided through a range of methods such as on-the-job training, peer training, workshops and mutual secondments.

## APPROACHES AND METHODOLOGIES

Many of the approaches to teaching tend to overemphasize the manner in which information is transmitted to students, rather than what is learned, by whom, at what speed and for what purpose. This approach leads to passive attitudes towards the student's response. Learning, however, is a dynamic and interactive process in which the behaviour and experience of the students are vital components. In advocating so-called participatory approaches to education and training, modern adult education theories recognize that students must not only receive but contribute – that their perception of what is taking place is equally as important as that of their teachers, and the value that they place on specific learning activities is as relevant as that of their teachers and examiners. Furthermore, adults learn best when they are actively involved in the process rather than when they are passive receivers of information.

Good conventional teaching has always sought to take account of the learner, but is often inhibited by rigid structures and methods. The rigid style imposed by large numbers, timetable requirements and the availability of teaching resources, as well as conventional approaches to course design, have led to "learning" aspects being overwhelmed by "teaching" aspects.

Education is most effective when it recognizes the context of behaviour, including an analysis of obstacles to applying what is learned. The development of participatory methods should be considered as a first step in empowering future professionals in being active partners in the delivery of environmental health services. The methods adopted under this approach should encourage the development of critical thinking, practical problem-solving and decision-making.

Many barriers exist to adopting participatory methods of teaching. Contact teaching time is considered to be too short, many teachers and lecturers are instinctively more comfortable with didactic teaching methods, and the students may be unused to such methods and unwilling to become involved. Cultural considerations are also an important factor, in terms of the availability of teaching material in relevant languages and the application of methods and materials that conform to social and cultural norms. Research appears to indicate that successful curricula encompass a variety of methodologies that provide participants with a wide range of learning experiences.

## ADVANTAGES AND DISADVANTAGES OF SELECTED METHODOLOGIES AND APPROACHES

The following (adapted from *(16)*) gives a brief guide to the various teaching methodologies and approaches available, with regard to their relative advantages and disadvantages.

### Lectures

Lectures are used to convey a basic body of information. They are most effective when combined with participatory exercises, which enable participants to apply the information presented. They are by far the most commonly used methods of teaching.

#### *Advantages*

- Apparent saving of time and resources
- Teacher present
- Covers large group of participants
- Enables teacher to cover theoretical issues in detail

#### *Disadvantages*

- Passive role of participants
- Does not foster problem-solving skills

- Difficult to gauge participants' progress in learning
- Does not allow for individual pace in learning
- Low receptivity on the part of the participants

## Small group activities

The purpose of these methods is to maximize participation and to allow the participants to use their own experiences and available resources to address questions or solve specific problems. They can also be used to generate interest in new topics, or to reinforce information learned in direct teaching sessions.

### *Advantages*

- Permits teacher/participant and participant/participant dialogue
- Case study exercises promote critical analysis, teamwork and problem-solving skills
- Facilitates evaluation

### Disadvantages

- High costs in personnel and time

## Problem-based learning

Problem-based learning is a process whereby participants learn by using a problem as a stimulus to discover the information they need to understand the problem and hasten is solution. It is an instructional method that involves the collection of carefully constructed problems presented to small groups of participants. Ideally, these problems describe real-life phenomena, and are derived from professional practice. The participants' task is to examine these problems, find intelligent explanations for their occurrence, and formulate ways of managing and solving them.

### *Advantages*

- Fosters the development of problem-solving skills
- Assists in developing teamwork
- Places emphasis on a multidisciplinary approach to solving complex issues

### Disadvantages

- Requires careful planning
- Requires high input of time by both participants and teachers

- Participants may be initially unfamiliar or uncomfortable with the approach

### Multiprofessional education

This method takes account of the fact that education and training in one discipline does not adequately prepare members of different environmental health professions for applying disciplines and skills other than their own. It enables those trained in one discipline to learn about other disciplines, to recognize their abilities in those disciplines, and to see how they contribute to the resolution of environmental health issues. Such training also enables participants to devise ways of preventing or solving conflicts that can arise during teamwork.

#### *Advantages*

- Develops the ability of participants to share knowledge and skills
- Helps develop teamwork, mutual respect and understanding, and helps different disciplines to understand ways in which each can contribute to the solution of health problems
- Helps to decompartmentalize curricula
- Encourages the integration of new skills and areas of knowledge that contribute to environmental health
- Helps teachers of various disciplines to communicate more easily

#### *Disadvantages*

- Practical difficulties such as timetabling, assessment and funding
- Assessment of respective professional roles must be handled with sensitivity

### Demonstrations

These methods provide the opportunity either to present participants with practical examples that reinforce theoretical work covered in previous work, or to demonstrate correct methodologies for carrying out specific tasks in a controlled situation.

#### *Advantages*

- Presence of teacher
- Develops observational skills
- Ensures close contact with concrete issues

- Facilitates the acquisition of practical intellectual and communication skills
- Presents reality
- Permits logical step-by-step presentation
- Can be attention-catching
- Demonstrates the correct methods for doing complex tasks
- Makes it possible to ask questions
- Limits potential damage to equipment and material when participants do practical work afterwards

### *Disadvantages*

- Number of participants must be limited
- Keeps participants in passive role
- Difficult to check learning process
- Does not allow for individual pace of learning
- High cost in personnel and time
- Specimens and materials may not be readily obtainable
- Difficult for participants to repeat the demonstration in order to acquire competence

## Practical and field work

### *Advantages*

- Puts the participants in an active situation
- Permits evaluation of the degree to which educational objectives (practical and communication skills) have been attained
- Develops qualities of observation and decision-making
- Ensures closer contact with real situations
- Permits comparison between practice and theory
- Enables participants to develop self-confidence
- Increases diversity in learning experiences

### *Disadvantages*

- High costs in terms of personnel
- Covers limited number of participants
- Can put teaching staff and participants into difficult or unpredictable situations
- Difficult to achieve standardization
- Requires careful planning and evaluation
- Requires major input from outside bodies and groups

## Workshops

Workshops generally range from several hours to several weeks and incorporate a style of education that minimizes formal lecturing and presentations while emphasizing active learning by the participants. The most important aim in workshops is not to teach the participants new facts and skills, or indeed to persuade them to accept proposals or solutions presented by the workshop team; it is to provide a setting in which the participants themselves will reach decisions, make plans and initiate change.

### *Advantages*

- Focuses attention of participants on specific issues for a limited period of time
- Emphasizes problem-solving processes and skills
- Fosters pooling of knowledge and experience among participants
- Provides a solid basis for follow-up

### *Disadvantages*

- Requires very careful planning
- Difficult to predict or evaluate outcome
- Potential for follow-up must exist

## Role-playing

Role-playing provides the opportunity to act out problem situations rather than simply having them described and analysed. Role-playing is particularly effective in exploring attitudes and developing interpersonal communication skills, and is particularly useful in conjunction with group discussions in order to analyse particular issues. It provides participants with both the opportunity to practise communication skills and the possibility to empathize with wide-ranging and conflicting points of view on environmental health issues.

### *Advantages*

- Gives participants the opportunity, in a controlled situation, to develop real communication skills and to obtain constructive feedback from peers and teachers
- Helps participants through confrontational situations, and gives them the opportunity to develop empathy and understanding of other people's points of view

### *Disadvantages*

- Time-consuming
- Largely dependent on imagination of participants
- Teachers and/or participants may be uncomfortable with this method

## Self-directed learning

Self-directed learning includes research, case studies, theses, dissertations and learning packages (including books, handouts, etc.). It can involve intensive study or research on particular issues for periods of from several hours to several months or even years.

### *Advantages*

- Enables participants to work at their own pace
- Facilitates self-evaluation
- Makes possible mass teaching of high efficiency
- Facilitates decision-making skills
- Avoids teacher bias
- Allows teachers to concentrate on more complex issues
- Can be kept up to date with scientific developments

### *Disadvantages*

- Requires special educational competence
- High additional costs in terms of teaching materials and teacher time
- No group dynamics

## Models and simulation devices

### *Advantages*

- Three-dimensional and introduces concept of reality
- Facilitates close examination and magnification
- Can be used to demonstrate functions as well as construction
- Can permit learning and practise of different techniques

### *Disadvantages*

- Often expensive or difficult to find locally
- Usually only usable in small groups
- Easily damaged and expensive to repair
- Never as effective as the real situation

## Audiovisual materials

These cover a very diverse range of materials and methods, in terms both of their potential use and of their cost. They include blackboards, flipcharts, graphics, overhead transparencies, slides, tape recordings and videotapes (television and radio are dealt with separately below).

### *Advantages*

- Potentially inexpensive and easily reproduced
- Usable for a wide range of topics
- Allows step-by-step build-up of concepts
- Shows real situations
- Easy to store, catalogue and retrieve
- Can be used repeatedly
- Can be adapted to size of audience
- Small objects can be projected
- Can attract and hold attention
- Most equipment used is reasonably portable

### *Disadvantages*

- Materials are often fragile or easily erased
- Needs good level of skill to produce good materials
- Skills for effective use are not usually taught to those using them
- Special conditions and facilities may be necessary
- Reproduction costs for some audiovisual materials may be very high

## Broadcast media (television and radio)

### *Advantages*

- Adaptable to large audiences over a wide geographical area
- Capable of maintaining attention
- Conserves resources by allowing simultaneous contact with large numbers of participants
- If combined with prepared materials, can be a powerful learning tool
- Equipment for reception widely available

### *Disadvantages*

- Production of programmes expensive and requires specialist staff

- No immediate interaction or feedback available
- Learner may have to adapt to fixed schedule if recording facilities are not available

## Computer-assisted training

### *Advantages*

- Large amounts of educational materials can be stored and accessed with ease
- Interactive retrieval and use of information
- Well suited to problem-solving and programmed examination
- Allows for individual pace of learning
- Can be adapted to individual and group learning
- Possible to provide links to worldwide range of educational, research and other institutions

### *Disadvantages*

- Acquiring relevant software can be expensive
- High capital and maintenance costs of hardware
- Highly skilled staff required
- Participants need computer skills for effective use

## Peer training

This method of training incorporates the sharing of knowledge, skills and attitudes among professionals of a similar level, where the "teaching/facilitating" role is taken on either by the learners themselves or by other professionals. It can be incorporated into various scenarios, including on-the-job training and practical demonstrations.

### *Advantages*

- Promotes sharing of experience between professionals
- Allows certain issues to be dealt with in a non-confrontational manner
- Parity of participants encourages openness on difficult issues

### *Disadvantages*

- Difficult to monitor and evaluate
- Danger that misconceptions might be perpetuated
- Additional resources needed to assist teachers/facilitators to develop communication skills

## GUIDELINES FOR SPECIFIC LEARNING OBJECTIVES AND LEARNING EXPERIENCES

Deciding on the most appropriate methodology or approach to use in teaching specific elements of environmental health is an important question for all educators. Table 2 outlines some general guidelines on choosing an appropriate range of methodologies and approaches, bearing in mind that many other factors such as the type of target audience and availability of resources are also important determinants.

**Table 2. Learning experiences**

| Learning objectives | Lecture or demonstration | Small group discussion | Self-directed environment | Practice in controlled environment | Normal working environment |
|---|---|---|---|---|---|
| Orientation | X | | | | |
| Acquire knowledge and understanding | X | X | X | | |
| Consolidate knowledge and understanding | | X | X | | |
| Apply knowledge and understanding | | X | | X | X |
| Practise skills | | X | | X | X |
| Change attitudes | | X | | X | X |

# 3

# Evaluating Systems in Educational Programmes

Evaluation in education is a systematic process that facilitates measurement of the extent to which a student has attained the educational objective. Evaluation always includes measurements (quantitative or qualitative) plus value judgement. As evaluation theory and practice have developed in the education field over the years, it has been observed that evaluation serves a number of different functions.

Formative evaluation is used to develop and improve existing educational programmes (or activities, courses or individuals). It is designed to show how much students still have to learn in order to achieve their objectives. Formative educational measures the progress or gains made by students *during* the course of an educational programme. In doing so, it enables learning activities to be adjusted in accordance with progress or the lack thereof. It provides useful feedback to students and encourages them to seek assistance, as well as providing teaching staff with qualitative and quantitative data that can be use to modify the programme if necessary.

Summative evaluation is generally used for accountability, certification or selection purposes. It is designed to protect society by preventing incompetent persons from practising in a particular discipline, and is traditionally used for placing students in order of merit and justifying decisions on whether to advance students up to the next class or stage or to award a certificate of competence.

Administrative evaluation is used to facilitate supervision within organizations. It is used to facilitate the supervision and evaluation of teaching staff and educational programmes. The educational programme must be subject to careful scrutiny and evaluation before implementation to ensure that the various components that contribute to its success are in place. An evaluation system must include plans to monitor the implementation of the programme.

Psychological or sociopolitical evaluation is used to increase awareness of special activities or to promote public relations.

## WHY EVALUATE?

Society, which ultimately foots the bill for environmental health services, relies on competent environmental health professionals to perform according to the needs and demands of society. Environmental health-related activities, by their nature, tend to stimulate and provide leverage for social awareness. Evaluation is absolutely crucial in judging the whether the education and training given to environmental health professionals is meeting the needs of society.

In general there are four main reasons for evaluation *(39)*:

1. to describe what has been done – if there is no record of whether objectives have been achieved, there is no basis for future planning;
2. to improve what is being done – a critical analysis of the implementation of an educational programme will show features, such as objectives, methods and time-frames, that can be improved;
3. to judge what is being done – when an educational programme has been in place for some time, decisions have to be made about its future; and
4. to evaluate and motivate those involved in the programme in working together towards agreed objectives.

The chief goal of the education process is to bring about changes in human behaviour. The kinds of behavioural change that an educational institution attempts to bring about constitute the objectives of that institution.

Evaluation consists in finding out the extent to which these objectives have been attained, and in determining the quality of the teaching personnel and techniques used. The nature of the measurement and appraisal techniques used to evaluate an educational programme will profoundly influence the type of learning that takes place. Utilizing a wide range of evaluation techniques, covering the various learning objectives, will thus lead to varied learning and teaching experiences.

## WHO AND/OR WHAT SHOULD BE EVALUATED?

Those to be evaluated in educational terms are students, teaching staff, and programmes and courses. The aims of evaluating students are primarily to:

- determine their success or failure in achieving the learning objectives of the course;
- provide them with feedback on the instruction being received, to let them know what level they have reached;
- make them aware of those parts of the instruction that they have not understood; and
- provide feedback to the teacher on how much students have understood, so that the teaching can be modified as necessary.

The aim of evaluating teaching staff is primarily to ensure that they are competent and comfortable with the teaching methodologies. If necessary, additional training must be provided to equip them with the necessary skills. It also ensures that teaching staff understand and are working towards attaining the objectives of the educational programme.

The main benefit of evaluation is that it takes into account the fact that all educational programmes experience failures or problems at some point. Unless there is a proper evaluation for formative purposes it may be difficult, if not impossible, to understand why a course or programme has failed. Continuous evaluation offers the opportunity to prevent such failures. Evaluation should be built into all phases of programme construction.

## METHODOLOGIES FOR EVALUATING STUDENTS

Evaluation methods are commonly designed to evaluate students in each of the domains of human intellect that contribute to competence, namely:

- evaluation of knowledge and intellectual ability;
- evaluation of practical skills; and
- evaluation of attitudinal competence.

The steps used in evaluating students are based on the criteria of the educational objectives, as follows:

1. the development and use of measuring instruments;
2. the interpretation of measurement data; and
3. the formulation of judgements and taking of appropriate action.

Appropriate measuring instruments to evaluate students in the domains of knowledge, skills and attitudes must be utilized if the evaluation process is to be sound. The main qualities of such measuring instruments are:

*Validity* – the extent to which the test actually measures what is intended to be measured;
*Reliability* – the consistency with which an instrument measures a given variable;
*Objectivity* – the extent to which independent and competent examiners agree on what constitutes a good answer; and
*Practicability* – the overall simplicity in the use of a test, both for the deviser of the test and the student; this depends on the time required to set, administer and mark an examination and to interpret the results, as well as its overall simplicity in use.

The main methodologies used for evaluating students include essays and oral, multiple-choice and practical examinations. Table 3

## Table 3. Advantages and disadvantages of different types of test

| Advantages | Disadvantages |
|---|---|
| ***Oral examinations*** | |
| Permit direct contact with candidates<br>Provide an opportunity to take a wide range of circumstances into account<br>Provide flexibility in moving from the candidates' strong points to weak points and vice versa<br>Require candidates to formulate their own replies without cues<br>Provide an opportunity to question candidates about thought processes underlying an answer<br>Provide an opportunity for simultaneous assessment by two or more assessors | Lack standardization<br>Lack objectivity and reproducibility of results<br>Permit favouritism and possible abuse of personal contact<br>Can be affected by a shortage of trained examiners<br>Are excessively costly in terms of professional time taken to obtain information of relatively limited value |
| ***Essays*** | |
| Provide candidates with an opportunity to demonstrate their knowledge and ability to organize ideas and express them effectively | Amount of students' total work that can be sampled is severely limited<br>Lack objectivity<br>Provide little useful feedback<br>Marking and interpreting of results is time-consuming |
| ***Multiple-choice examinations*** | |
| Ensure objectivity, reliability and validity<br>Increase significantly the range and variety of facts that can be sampled in a given time<br>Permit precise and unambiguous measurement of results<br>Provide detailed feedback for both students and teaching staff<br>Are easily and rapidly marked | Take a long time to devise if arbitrary and ambiguous questions are to be avoided<br>Require careful preparation to avoid a preponderance of questions that only test recall<br>Give cues to students that will not exist in practice<br>May oversimplify issues for the sake of clarity |
| ***Practical examinations*** | |
| Provide an opportunity to test various skills in a realistic setting while the examiner observes and checks performance<br>Provide an opportunity to confront candidates with problems they have not previously encountered and to test their abilities, as opposed to applying "ready made" solutions<br>Provide an opportunity to observe and test attitudes and responsiveness to complex situations<br>Can be recorded and taped for later examination and feedback<br>Provide the opportunity to test the ability to communicate under pressure, to discriminate between important and trivial issues, and to arrange results in a final form | Ensuring standardization of conditions is difficult<br>Lack objectivity and may be influenced by irrelevant factors<br>Are of limited feasibility for large groups<br>Require a high level of observational skill on the part of examiners |

shows some of the main advantages and disadvantages of these methodologies.

## EVALUATING TEACHING STAFF AND TEACHING METHODS

There is a growing awareness in many countries that selecting teaching staff in institutes of higher education solely on the basis of their scientific or academic merits is not an appropriate strategy for improving educational programmes. While scientific and academic ability is essential, teaching staff in these institutes must also be competent as communicators, educational designers, instructors and users of teaching media and materials. There are a number of ways of evaluating this competence, and all these methods should be integrated into an overall evaluation exercise.

Teaching performance can be evaluated in terms of learning objectives attained, examination results achieved and the percentage of successful students progressing to the next stage of the educational programme. Another way is to observe and evaluate teaching techniques utilized by teaching staff, in the context of the relevant learning objectives for that particular learning activity. This is, in effect, an evaluation of the educational process, and can be achieved through various forms of direct observation of teaching, followed by debriefing and discussion with the teaching staff. It can be very effective if facilities for recording and playing videotapes are available. A similar method involves the use of a preset questionnaire by the evaluator, based on a model of desired performance by the teaching staff in question.

Objective measurement techniques can be used, which may, for example, measure the frequency of different activities during learning sessions. These techniques may be used to measure criteria such as the number of instances a teacher is active and learners are passive during a learning session, the time spent by the teacher talking or the time spent working in groups. Another method involves pre-evaluating the skills and experience of teaching staff to identify those personnel with the requisite competence and experience to participate fully in the educational programme. Feedback from students is another important (and sometimes overlooked) evaluation method.

This can take the form of direct discussion and/or written questionnaires. A number of educational institutions encourage this form of evaluation by setting up teaching staff/student liaison groups.

## EVALUATING EDUCATIONAL PROGRAMMES IN ENVIRONMENTAL HEALTH

Quality management of educational programmes in environmental health is essential, and thorough evaluation of programmes is a vital element in this managerial process. The following guidelines (adapted from *21*), provide a general overview of the steps involved in the evaluation process. The four phases in this process are orientation, evaluation design, the gathering of information on the programme and its effects, and analysis and reporting. Detailed steps in each phase are given below.

### Orientation

1. Determine the general characteristics of the educational programme.

2. Ascertain the general characteristics of the administrators, teaching staff and students.

3. Determine the financial resources and physical facilities available.

4. Clarify the aims of the proposed evaluation.

5. Make an inventory of the readily available information about the educational programme.

6. Determine the resources available for the evaluation.

7. Clarify the role of those involved in the evaluation process.

8. Make a preliminary appraisal of the nature and feasibility of the proposed evaluation.

### Evaluation design

1. List the questions and issues to be considered.

2. Determine the appropriate sources of information and the procedures for collecting it.

3. Design the evaluation.

4. Draw up the evaluation schedule and budget.

5. Obtain feedback.

## Gathering information on the programme and its effects

1. Describe the context in which the programme operates.

2. Describe the objectives with regard to:

- the future function, taking into account the main environmental health-related issues and the tasks and responsibilities deriving from each; and
- the learning objectives, taking into account the principal tasks the students should be able to perform satisfactorily at the end of the programme.

3. Ascertain students' characteristics that are likely to affect their performance as learners and subsequently as workers.

4. Gather information on students at the beginning of their training.

5. Make an inventory of the resources available and describe how they are allocated.

6. Examine and record the training process used in the programme.

7. Make a summary of information relating to students' learning experience.

8. Identify the effects of the programme that are to be evaluated.

9. Critically examine and if necessary modify the assessment procedures already in use in the programme.

10. Devise procedures for observing long-term impact of the programme.

## Analysis and reporting

1. Use the information gathered in the previous phase to prepare a concise description of the programme.

2. Analyse the relationship between the various aspects of the programme.

3. Prepare an evaluation report recapitulating the qualities and achievements of the programme, problems encountered in carrying it out and the available options for improving it.

# 4

# Proposed Curricula for Environmental Health Professionals

This book has so far dealt with some of the individual components that contribute to the development of curricula. The purpose of this chapter is to give concrete recommendations on course content and timetabling for a series of proposed curricula. These proposed curricula are intended to act as templates that can be modified to address a broad range of courses for environmental health professionals at various levels. Recommendations are not made on the teaching and learning strategies to utilized; guidance on this may be founded in Chapter 2.

It is not within the scope of this book to provide detailed curricula for the 70 or more categories of environmental health professional identified in the Introduction. The approach that has been adopted is to propose curricula for environmental health professionals based on the earlier description of environmental health career pathways (Fig. 1, page 15).

## FORMAT OF CURRICULA

The curricula shown in Tables 4–9 are presented in modular form. It is usual to develop these modules in such a way so as to ensure a sequential approach to the learning experience; in other words, to ensure that the participants in the educational programme build on the competences gained throughout the course. The course module contents are presented in outline form. The depth to which particular topics within each module should be covered will be determined by the specific needs of Member States and the particular functions proposed for participants of these courses.

In the proposed curricula, a recommended number of hours of direct-contact teaching time has been suggested. This should be considered as a general guide only. In relation to "add-on" curricula, it is assumed that appropriate exemptions might be granted for particular subjects on the basis of the individual student's previous experience and academic education.

The proposed modules have been divided into the following five classes.

## Basic modules

These modules are intended to provide the basic grounding necessary for environmental health professionals in the main sciences and allied areas. They are also intended to provide an introduction to the concepts of health and environmental health and to provide the basis within which more specific environmental health issues can be considered.

## Applied modules

These modules serve to engage students in specific areas of environmental health interest, such as air and water quality, food safety, environmental protection and human habitation. These modules will provide students with the in-depth knowledge necessary to deal with specific problems within each of the appropriate areas. The structure of such modules depends entirely on the particular needs and resources of the society the students will ultimately serve. The depth of knowledge required in each of these areas will also vary in accordance with the needs of the society served.

## Holistic modules

As stated earlier, environmental health offers as a philosophy and a discipline a holistic approach to dealing with issues of environment and health. These modules are intended to provide students with the overview necessary to develop this holistic approach.

### Integrated modules

These modules are intended to provide students with an understanding and appreciation of the dynamic relationship that exists between the specific topics covered in other modules of the course, and to endow them with competences and tools to examine and utilize those relationships.

### Optional modules

These modules are intended to give students a background in specific topics or methodologies that may be appropriate to specific needs. In each case, the number of teaching hours (direct, tutorial and practical work) are also listed. It should be noted that where reference is made to practical/on-the-job training, the hours quoted refer to working hours and *not* teaching hours.

## PROPOSED CURRICULUM FOR ENVIRONMENTAL HEALTH TECHNICIANS/AIDES

This curriculum (Table 4) is envisaged as a four-semester course based in an educational institution, plus a period of guided practical training in an environmental health service. The timetable is based on an academic semester of 14 weeks, with an average of 24 hours of direct teaching per week.

## PROPOSED CURRICULUM FOR GENERAL TECHNICIANS/AIDES

One purpose of including this curriculum (Table 5) is to support the notion that technicians and aides from allied fields who receive appropriate training and education can work as effective environmental health service personnel. The overall aim of such a curriculum is to provide the additional training necessary for such technicians to operate on a common level with those specifically trained in the environmental health field.

The target group for such a course might conceivably be drawn from a wide range of technical backgrounds, with a strong grounding in the basic and applied modules proposed. This being the case, the number of hours allotted to each subject should be considered

## Table 4. Proposed curriculum for environmental health technicians/aides[a]

| Basic modules | Applied modules | Integrated modules | Holistic modules | Optional modules (any 2) |
|---|---|---|---|---|
| Biological sciences (140) | Food quality and safety (98) | Practical/ on-the-job professional training[b] | Environmental health education and promotion (42) | Advanced food quality and safety (28) |
| Physical sciences (140) | Human habitation (56) | Case study report[c] | Environmental health studies (42) | Advanced human habitation (28) |
| Information sciences (70) | Occupational health and safety (56) | Toxicology (56) | Public health and epidemiology (56) | Advanced occupational health and safety (28) |
| Social sciences (70) | Water sciences (98) | Laboratory techniques (56) | | Advanced water sciences (28) |
| Legal and administrative studies (42) | Soil pollution (42) | | | Advanced atmospheric and meteorological sciences (28) |
| Building and construction technology (70) | Atmospheric and meteorological sciences (56) | | | |
| | Noise and acoustics (42) | | | |
| | Radiological safety (42) | | | |

[a] The number of hours is given in parentheses.

[b] 840 working hours.

[c] Variable – minimum of 60 hours of directed study.

Total direct teaching (including contact teaching, tutorial and practical work) = 1344 hours.

as being very discretionary. The granting of exemptions to participants suitably qualified in some of these modules, while significantly increasing the hours allotted to other modules, would be an element of the flexibility in implementing such a curriculum. The basic modules, in particular, might be considered as "top-up" modules to enhance previous courses in the relevant area. Given that the participants in such a course already have some experience in self-directed research, the number of hours of direct contact teaching has been reduced in several modules. Where such experience is lacking, it may be advisable for participants to follow the full basic module in the environmental health technician/aide curriculum (Table 4).

Table 5. Proposed curriculum for general technicians/aides[a]

| Basic modules | Applied modules | Integrated modules | Holistic modules | Optional modules (any 2) |
|---|---|---|---|---|
| Environmental biological sciences (42) | Food quality and safety (56) | Practical/ on-the-job professional training[b] | Environmental health education and promotion (42) | Advanced food quality and safety (28) |
| Environmental physical sciences (42) | Human habitation (42) | Case study report[c] | Environmental health studies (42) | Advanced human habitation (28) |
| Information sciences (28) | Occupational health and safety (42) | Toxicology (28) | Public health and epidemiology (56) | Advanced occupational health and safety (28) |
| Social sciences (42) | Water sciences (56) | Laboratory techniques (56) | | Advanced water sciences (28) |
| Legal and administrative studies (28) | Soil pollution (28) | | | Advanced atmospheric and meteorological sciences (28) |
| Building and construction technology (42) | Atmospheric and meteorological sciences (42) | | | |
| | Noise and acoustics (28) | | | |
| | Radiological safety (28) | | | |

[a] The number of hours is given in parentheses.

[b] 560 working hours.

[c] Variable – minimum of 60 hours of directed study.

Total direct teaching (including contact teaching, tutorial and practical work) = 826 hours.

The time allotted to the integrated and holistic modules, however, has been generally maintained in line with the environmental health technician/aide curriculum. For those required to follow all the modules, it is envisaged that this course would be run over two semesters of 14 weeks each, with an average of 30 hours of contact teaching per week.

## PROPOSED CURRICULUM FOR ENVIRONMENTAL HEALTH PROFESSIONALS

This curriculum (Table 6) is envisaged as a seven-semester course based in an educational institution,plus one period of guided practical training in an environmental health service. The timetable is based on an academic semester of 14 weeks, with an average of 25 hours of direct teaching per week.

### Table 6. Proposed curriculum for environmental health professionals[a]

| Basic modules | Applied modules | Integrated modules | Holistic modules | Optional modules (1 of 2) |
|---|---|---|---|---|
| Biological sciences (196)<br>Physical sciences (196)<br>Information sciences (84)<br>Social sciences (84)<br>Legal and administrative studies (70)<br>Building and construction technology (98) | Food quality and safety (154)<br>Human habitation (98)<br>Occupational health and safety (98)<br>Water sciences (154)<br>Radiological safety (98)<br>Land-use planning (98)<br>Organizational management (84)<br>Noise and acoustics (42)<br>Soil pollution (70)<br>Atmospheric and meteorological sciences (98)<br>Applied linguistics (84) | Practical/ on-the-job professional training[b]<br>Project dissertation[c]<br>Risk management (70)<br>Multimedia pollution control (42)<br>Waste management (70)<br>Toxicology (56)<br>Safety and emergency management (42)<br>Vector control (42)<br>Research techniques (28) | Environmental health education and promotion (70)<br>Environmental health studies (70)<br>Public health and epidemiology (84) | Environmental engineering (84)<br>Environmental health impact assessment and auditing (84) |

[a] The number of hours is given in parentheses.

[b] 840 working hours.

[c] Variable – minimum of 250 hours of self-instruction.

Total direct teaching (including contact teaching, tutorial and practical work) = 2450 hours.

## PROPOSED CURRICULUM FOR ALLIED GENERALISTS/SPECIALISTS

This proposed curriculum (Table 7) is intended to act as a template for a wide range of allied professionals who, on receipt of appropriate training, can work effectively as environmental health service personnel. Such a curriculum could be tailored to suit the needs of a very wide range of professionals.

Given the wide target audience for this particular curriculum, a less didactic approach has been adopted. First it is intended that this curriculum should be used in the training of postgraduate students who have at least a primary degree or equivalent in a relevant

**Table 7. Proposed curriculum for allied generalists/specialists**[a]

| Basic modules (100) | Applied modules (160) | Integrated modules (100) | Holistic modules (120) | Optional modules (1 of 2) (60) |
|---|---|---|---|---|
| Information sciences | Food quality and safety | Practical/on-the-job professional training | Public health and epidemiology | Environmental engineering |
| Social sciences | Human habitation | Project dissertation | Environmental health education and promotion | Environmental health impact assessment and auditing |
| Legal and administrative studies | Occupational health and safety | Risk management | Environmental health studies | |
| Building and construction technology | Water sciences | Multimedia pollution control | | |
| | Radiological safety | Waste management | | |
| | Land-use planning | Environmental health services management | | |
| | Noise and acoustics | Toxicology | | |
| | Soil pollution | Safety and emergency management | | |
| | Atmospheric and meteorological sciences | Vector control | | |
| | Applied linguistics | | | |

[a] The total number of hours of each module is given in parentheses.

discipline. A sufficiently strong background in the biological and physical sciences would be an essential prerequisite to participation in this course. A suitable foundation course in the biological and physical sciences of approximately 200 hours would be necessary for candidates who do not posses qualifications.

The issue of contact teaching hours has been dealt with differently in this case in order to emphasize the inherent need for flexibility. In this instance, a total contact teaching time for each group of modules is proposed at the top of each column.

The total course is envisaged as taking place over two semesters each of 14 weeks, with approximately 20 hours of contact teaching per week. While this may seem an excessive number of hours, it is anticipated that teaching methods would be less didactic than in other courses.

It is also anticipated that such courses would incorporate a discretionary period of practical or on-the-job training and the completion of a dissertation on a relevant topic. Exemptions might be granted from particular modules for students having a suitable level of proficiency in the basic, applied and some of the integrated modules, such as waste management or toxicology.

## PROPOSED CURRICULUM FOR ENVIRONMENTAL HEALTH SERVICE MANAGERS

This curriculum (Table 8) is primarily aimed at environmental health professionals with substantial working experience who are involved in the management of environmental health services. It is intended that this curriculum would assist in integrating much of the work experience of the participants and would assist them in developing the necessary competences for leadership within the environmental health services. It is also envisaged that such a course would provide a focal point for consolidating the broad range of academic backgrounds of those involved in the management of environmental health services.

The course is envisaged as spanning two semesters, each of 14 weeks, involving 15 hours of contact teaching per week. The

**Table 8. Proposed curriculum for environmental health service managers[a]**

| Basic modules | Applied modules | Integrated modules | Holistic modules | Optional modules (any 3) |
|---|---|---|---|---|
| Epidemiology (30) | Water quality management (10) | Toxicology (20) | Environmental health impact assessment and auditing (20) | Environmental health education methodologies (20) |
| Population and health statistics (20) | Air quality management (10) | Risk management (20) | Environmental health policy and legislation (20) | Linguistics (20) |
| Communication sciences (15) | Food quality management (10) | Project management (25) | Health promotion (20) | Health economics (20) |
| Environmental health economics (25) | Occupational health and safety (10) | Environmental health services management (30) | Environmental health services evaluation (10) | Health promotion management (20) |
| Human resource management (25) | Human habitation studies (10) | Project dissertation | | Human resource management (20) |
| | Radiological safety (10) | | | |
| | Land-use management (10) | | | |
| | Safety and emergency management (10) | | | |

[a] The number of hours is given in parentheses.

production of a dissertation on dealing with a relevant aspect of environmental health management would be an essential element of the course.

Given the wide diversity of the target audience for such a course, the applied courses could be dealt with as electives, or exemptions could be granted in specific instances.

## PROPOSED CURRICULUM FOR MANAGERS OF OTHER SECTORS

This curriculum (Table 9) is aimed at those managers of other sectors who are involved in some aspects of environmental health

Table 9. Proposed curriculum for managers of other sectors[a]

| Basic modules | Applied modules (any 4) | Integrated modules | Holistic modules | Optional modules (any 2) |
|---|---|---|---|---|
| Environmental health studies (15) | Water quality management (15) | Toxicology (10) | Environmental health impact assessment and auditing (20) | Environmental health education methodologies (20) |
| Public health and epidemiology (20) | Air quality management (15) | Risk management (20) | Environmental policy and legislation (20) | Linguistics (20) |
| Health promotion (15) | Food quality management (15) | Multimedia pollution health control (20) | Environmental health services evaluation (10) | Health economics (20) |
| Health economics (10) | Occupational health and safety (15) | Project case study report | | Health promotion management (20) |
| | Human habitation studies (15) | | | |
| | Radiation safety (15) | | | |
| | Land-use management (15) | | | |
| | Safety and emergency management (15) | | | |

[a] The number of hours is given in parentheses.

management. The main purpose of the curriculum is to provide these managers with the holistic overview necessary to enable them to contribute to the overall management and protection of environmental health at a variety of levels. It is assumed that such managers would already occupy a senior level within their own sector. The course is envisaged as a 260-hour intensive programme concentrating on policy and management issues. It could be dealt with as a two-semester course, each semester being 14 weeks long, with nine hours of contact teaching time per week. The completion of a case study report dealing with a relevant aspect of the participant's involvement in the environmental health field would be an essential element of the educational programme.

# References

1. FITZPATRICK, M. & BONNEFOY, X. *Environmental health services in Europe 3. Professional profiles.* Copenhagen, WHO Regional Office for Europe, 1998 (WHO Regional Publications, European Series, No. 82).
2. MACARTHUR, I. & BONNEFOY, X. *Environmental health services in Europe 1. An overview of practice in the 1990s.* Copenhagen, WHO Regional Office for Europe, 1997 (WHO Regional Publications, European Series, No. 76).
3. MACARTHUR, I. & BONNEFOY, X. *Environmental health services in Europe 2. Policy options.* Copenhagen, WHO Regional Office for Europe, 1997 (WHO Regional Publications, European Series, No. 77).
4. *Targets for health for all. Targets in support of the European regional strategy for health for all.* Copenhagen, WHO Regional Office for Europe, 1985 (European Health for All Series, No. 1).
5. *Health for all targets. The health policy for Europe.* Copenhagen, WHO Regional Office for Europe, 1993 (European Health for All Series, No. 4).
6. WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT. *Our common future.* Oxford, Oxford University Press, 1987.
7. *Environment and health: the European Charter and commentary.* Copenhagen, WHO Regional Office for Europe, 1990 (WHO Regional Publications, European Series, No. 35).
8. *Our planet, our health. Report of the WHO Commission on Health and Environment.* Geneva, World Health Organization, 1992.

9. *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3–14 June 1992.* New York, United Nations, 1992 (document A/Conf. 151/26 (Vol. 1)).
10. *Towards sustainability. A European Community programme of policy and action in relation to the environment and sustainable development.* Brussels, Commission of the European Communities, 1992 (document COM92.23).
11. *Implementation of the Global Strategy for Health for All by the Year 2000, second evaluation. Eighth report on the world health situation, Vol. 5, European Region.* Copenhagen, WHO Regional Office for Europe, 1994 (WHO Regional Publications, European Series, No. 52).
12. *Environment for Europe. Ministerial Conference, Lucerne, 28–30 April 1993.* Berne, Federal Office for the Environment, 1993.
13. *Environment and health. Report on the Second European Conference, Helsinki, Finland, 20–22 June 1994.* Copenhagen, WHO Regional Office for Europe, 1995 (document EUR/ICP/CEH 212 (FIN)).
14. *Environmental Health Action Plan for Europe.* Copenhagen, WHO Regional Office for Europe, 1995 (document EUR/ICP/CEH 212 (A)).
15. *Second Consultation on Environmental Health Services. Technical report on a WHO consultation, Vilnius, Lithuania, 28–30 November 1994.* Copenhagen, WHO Regional Office for Europe, 1994 (document EUR/ICP/EPOL 94 03/MT05).
16. *Action plan for environmental health services in central and eastern Europe and the newly independent states. Report on a WHO consultation, Sofia, Bulgaria, 19–22 October 1993.* Copenhagen, WHO Regional Office for Europe, 1994 (document EUR/ICP/CEH 123).
17. Schilling, T. *Subsidiarity as a rule and a principle, or: taking subsidiarity seriously.* Cambridge, MA, Harvard Law School, 1995.
18. *The precautionary principle, industry and law-making.* Brussels, European Chemical Industry Council, 1995.
19. Calder, M. *Staffing, professional education and training in environmental health. Report on a WHO survey.* Copenhagen, WHO Regional Office for Europe, 1994.
20. Oshaug, A. et al. *Educational handbook for nutrition trainers. How to increase your skills and make it easier for students to learn.* Geneva, World Health Organization, 1993.

21. WHO European Centre for Environment and Health. *Concern for Europe's tomorrow. Health and the environment in the WHO European Region.* Stuttgart, Wissenschaftliche Verlagsgesellschaft, 1995.
22. National Academy of Sciences. *Risk assessment in the Federal Government: managing process.* Washington, DC, National Academy Press, 1983.
23. Sexton, K. Science and policy in regulatory decision making. Getting the facts right about hazardous air pollutants. *Environmental health perspectives,* **103**(Suppl. 6): 213–222 (1995).
24. *Risk communication dealing with the spectrum of environment and health risks in Europe. Report on a consultation, Ulm, 28–30 November 1990.* Copenhagen, WHO Regional Office for Europe, 1991 (document EUR/ICP/PCS 020/A).
25. *Research policies for health for all.* Copenhagen, WHO Regional Office for Europe, 1988 (European Health for All Series, No. 2).
26. *Educational programmes for health professionals.* Copenhagen, WHO Regional Office for Europe, 1994.
27. *Occupational hygiene in Europe: development of the profession.* Copenhagen, WHO Regional Office for Europe, 1992 (Occupational Health Series, No. 3) (document).
28. *Bachelor of applied science (environmental health) curricula.* Adelaide, Flinders University of South Australia, 1993.
29. *Assessment of professional competence. Candidate manual.* London, Chartered Institute of Environmental Health, 1995.
30. *Staffing, professional education and training needs in environmental health services for the central Asian republics. Report on a WHO workshop.* Copenhagen, WHO Regional Office for Europe, 1996 (document EUR/ICP/NEAP 04 03 01).
31. *Environmental health and the role of medical professionals. Report on a WHO consultation.* Copenhagen, WHO Regional Office for Europe, 1996 (document EUR/ICP/NEAP 01 02 04).
32. Last, J.M. *A dictionary of epidemiology.* Oxford, Oxford University Press, 1988.
33. *Teacher's guide for one-week training workshop: basic environmental epidemiology.* Geneva, World Health Organization, 1994 (document WHO/EHG/94.1).
34. Bury, J. A. et al. *Training in public health. Strategies to achieve competences.* Copenhagen, WHO Regional Office for Europe,

1994 (Training and Research in Public Health Dialogue Series, No. 2) (document).

35. *Priority research for health for all.* Copenhagen, WHO Regional Office for Europe, 1988 (European Health for All Series, No. 3).
36. *The assessment of professional competence scheme. Assessors' manual.* London, Chartered Institute of Environmental Health, 1991.
37. *WHO global strategy for health and environment.* Geneva, World Health Organization, 1993 (document WHO/EHE/93.2).
38. *Health and environment library modules, WHO component. Bibliographic references.* Geneva, World Health Organization, 1995 (document WHO/EHG/95.7).
39. ABBATT, F.R. & MEJÍA, A. *Continuing education of health workers. A workshop manual.* Geneva, World Health Organization, 1988.

# Detailed Curriculum for Environmental Health Technicians/Aides

## BASIC MODULES

### Biological sciences

*Prerequisites*
Secondary school level science subject.

*Learning objectives*
To enable students to:

- demonstrate an understanding of the fundamental biological and ecological concepts and an appreciation of their environmental significance;
- describe and understand the diversity of life;
- gain an appreciation of both the beneficial and harmful effects of various groups of microorganisms; and
- develop skills to conduct basic investigations and to interpret and evaluate results.

*Module content*
Cellular biology.
Basic biochemistry.
Taxonomy.
Energetics.

Vital life processes.
Histology.
Genetics.
Evolution and speciation.
Human physiology.
Microbiology: origins and methods.
Contemporary classification of bacteria, fungi, moulds and viruses.
Pathogens: toxicity and invasiveness; modes of transmission of disease; environmental risk factors; evaluation of risk factors; bacterial pathogens; viruses of human and animal origin.
Parasitology.
Entomology.
Control of microbial growth: principles; methodologies; industrial and medical applications.

## Physical sciences

### *Prerequisites*

Secondary school level science subject and mathematics.

### *Learning objectives*

To enable students to:

- demonstrate an understanding of the fundamental concepts of the physical and chemical sciences;
- understand the function and application of instrumentation for environmental measurement;
- develop the skills to enable them to undertake simple laboratory techniques and interpret results;
- understand the relationship between the concepts of physical and chemical sciences to environment and health.

### *Module content*

Physics: mechanics; properties of matter; solids, liquids and gases; heat, vibration and waves; electricity.
Chemistry: atomic and molecular theory; properties of organic and inorganic compounds; chemical reactions; stoichiometry; thermochemistry; electrochemistry; applied chemistry.

## Information sciences

### *Prerequisites*

Secondary school level mathematics.

### *Learning objectives*

To enable students to:

- gain a working knowledge of the principal methods for the statistical description and analysis of observed data;
- develop an understanding of data analysis and presentation techniques;
- develop an understanding of how to undertake a research project;
- gain familiarity with the concepts of computing and practical experience of relevant information technology applications;
- develop an understanding of the importance of communication skills;
- develop an understanding of the various means available for effective communication; and
- develop communication skills appropriate to a wide range of situations.

### *Module content*

Statistics: data collection; presentation of data; sampling techniques; frequency distribution; correlation; regression analysis; probability.

Calculus.

Information technology: word processing spreadsheets and databases; integrated office-based systems; data analysis systems; peripherals.

Communications: principles and systems; methods of communication; barriers to communication; professional communication techniques.

## Social sciences

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- gain an understanding of basic concepts of psychology and sociology;
- gain an understanding of basic social, economic and political concepts and factors;
- develop an awareness of the relationship between economy, society and government; and
- develop an understanding of management in the environment and health sector.

### *Module content*

Sociology: general introduction; culture; social stratification; influence of technology.

Social economics: macroeconomic principles and trends; competing theories of government and state.

Public and private sector models.

Health and environmental economics.

Ethics in health.

## Legal and administrative studies

This course provides students with an understanding of the legal and administrative framework within which the discipline of environmental health is practised.

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- develop an awareness of the influence of natural and constitutional justice underlying the legal system;
- gain an understanding of the mechanics of the legal system;
- acquire a foundation of legal knowledge sufficient for later and more advanced applications.

### *Module content*

Type, origin and purpose of national and international law.

National and international legal systems.

Judiciary and legal professions.

Principles of constitutional and administrative law.

Rules of evidence.
Framework of environment and health legislation at subnational, national and international levels.

### Building and construction technology

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- develop an understanding of the principles of building technology;
- appreciate the relationship of internal environments to building structure and fabric;
- understand the properties of building materials and their effects in building design and construction; and
- appreciate the factors involved in degradation of buildings.

*Module content*
Site preparation and investigation.
Building fabric characteristics.
Building components: walls, floors, roofing, stairs, etc.
Design and construction criteria.
Building fittings and finishes.
Building services: ventilation, lighting, heating, etc.
Construction systems.
Fire protection.

## APPLIED MODULES

### Food quality and safety

*Prerequisites*
Biology.

*Learning objectives*
To enable students to:

- develop an understanding of the characteristics of food commodities;
- develop an understanding of the causes of foodborne disease and the methods by which it can be prevented;
- appreciate the principles of food hygiene and safety and their application in ensuring a safe food supply; and
- appreciate the common pathological conditions affecting animals in the human food chain.

### *Module content*

Food biochemistry: classification, structure and functionality of living matter; cell structure and metabolism; biochemical nature of food commodities; concepts in nutrition.

Food microbiology: microbiological ecology; associated health risks (food pathogens and spoilage organisms; microbiological aspects of food production and preservation).

Food hygiene: food safety control; legislative and regulatory controls; food standards; foodborne illness; operational hygiene controls and systems, including HACCP.

## Human habitation

### *Prerequisites*

Building and construction technology.

### *Learning objectives*

To enable students to:

- understand the rationale for developing housing and urban strategies;
- appreciate the relationship between housing and habitation patterns on the one hand and health and wellbeing on the other; and
- understand the basis for determining courses of action for improving habitation standards.

### *Module content*

Types and determinants of and trends in human habitation.

Relationship between habitation, health and wellbeing.

Design and construction criteria for habitations.

Fitness assessment of human habitation.

## Occupational health and safety

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- recognize and evaluate hazards and to control risks arising from physical, chemical and biological agents in the workplace;
- understand monitoring strategies and the interpretation of results;
- appreciate the role of ergonomics in improving health and safety performance; and
- understand the principles of occupational health and hygiene and the legal framework for ensuring compliance with occupational health and safety standards.

### *Module content*

Concepts of occupational health and safety.
Occupationally related causes of mortality and morbidity.
Identification, assessment and measurement of hazards and risks.
Specific risk assessment: fire; explosion; noise; vibration; physical environment.
Chemical agents, etc.
Workplace design.
Protective equipment.
Legislative control.
Health promotion in the workplace.

## Water sciences

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the principles and mechanisms of the water cycle;
- appreciate the principles for the conservation and protection of water resources;

- appreciate the principles for water extraction and exploitation; and
- appreciate the importance of water quality to environmental health status.

### *Module content*

Hydrology: hydrometeorology; hydrological cycle; hydrological balance; water chemistry.
Water demand: water course systems; protection of water sources.
Hydrogeology: physical and chemical characteristics of aquifers; detection and sampling methods for groundwater.
Drinking-water supply: sources; supply; protection.
Public health aspects of water supply and protection.
Water usage for recreational and other uses.

## Soil pollution

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand basic geological and soil science principles; and
- appreciate the basic mechanics of soil pollution and its relationship to the pollution of other media.

### *Module content*

Review of geological principles and mechanisms.
Soil sciences: biochemistry; microbiology; mineralogy.
Classification of soils.
Soil and water pollution and associated health risks.

## Atmospheric and meteorological sciences

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the principles of meteorology and atmospheric dispersion;
- gain knowledge of the parameters used to describe air quality;
- appreciate the importance of air quality to environmental health status; and
- understand the physical principles involved in monitoring and controlling atmospheric pollutants.

### *Module content*

Basic meteorology.
Atmospheric dispersion.
Emission sources.
Impact of atmospheric pollutants on air quality, human health, etc.
Air pollution monitoring techniques.

## Noise and acoustics

### *Prerequisites*

Physical sciences.

### *Learning objectives*

To enable students to:

- understand the physical properties of sound;
- appreciate the effects of exposure to noise in a variety of settings;
- be aware of the factors influencing the propagation of noise; and
- be able to use noise measuring techniques and interpret results.

### *Module content*

Sound properties and measurement.
Human hearing mechanisms.
Sources of noise propagation.
Assessment procedures and equipment.
Attenuation/control measures and design.

## Radiological safety

### *Prerequisites*

Physical sciences.

### *Learning objectives*

To enable students to:

- understand the physics of radiation within environmental contexts;
- appreciate the biological effects of radiation exposure; and
- gain a working knowledge of analytical and quantitative techniques employed in environmental assessment and control.

### *Module content*

Review of the nature and characteristics of ionizing and nonionizing radiation.
Sources of exposure to ionizing and nonionizing radiation.
Biological effects of ionizing and nonionizing radiation.
Measurement techniques and instruments.
Principles and methodologies for protection from ionizing and nonionizing radiation.

## INTEGRATED MODULES

### Practical/on-the-job professional training

The organization of this module depends on national and subnational needs and resources.

### *Learning objectives*

To enable students to:

- have the opportunity to utilize and develop competences acquired in the academic courses; and
- gain experience of working in a professional environment as a member of a team.

### Case study

### *Learning objectives*

To enable students to:

- take responsibility for carrying out an investigation from initiation to a suitable stage of completion;

- develop the ability to analyse a problem, review published information, plan and organize an investigation and derive conclusions;
- apply skills and knowledge learned during the course; and
- integrate various components of the course in developing a study of suitable quality.

## Toxicology

### *Prerequisites*

Biological and physical sciences.

### *Learning objectives*

To enable students to:

- understand the forms, mechanisms and manifestations of toxic risk; and
- appreciate the various strategies for preventing and reducing toxic risks.

### *Module content*

Basic toxicology: mechanisms of toxic action; modifying factors; metabolism; storage and excretion; target sites; acute and chronic action; pathological effects.
Toxiometrics.
Biological monitoring.
Variety of toxic effects.
Occupational toxicology of metals, gases, solvents, pesticides and dust.
Biohazards.

## Laboratory techniques

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- acquire skills in working accurately, responsibly and independently in a laboratory setting;

- understand the variety of measurement techniques available; and
- reinforce knowledge and skills acquired in the biological and physical sciences.

## HOLISTIC MODULES

### Environmental health education and promotion

*Prerequisites*
Public health and information sciences.

*Learning objectives*
To enable students to:

- explore the concepts, role and situations of health promotion within the context of environmental health; and
- develop an understanding of the skills required to be an effective health promoter and educator within the context of their professional work.

*Module content*
Philosophies and methodologies for health promotion and education.
Health promotion concepts.
Educational techniques and forums.

### Environmental health studies

*Prerequisites*
Basic course modules and public health.

*Learning objectives*
To enable students to:

- develop an awareness of the interdisciplinary nature of environmental health issues; and
- gain an enhanced overview of the holistic nature of environmental health and the application of holistic approaches to dealing with issues.

### *Module content*

Historical perspective on the emergence of the environmental movement.

Evolution of environmental health from the national and international perspectives.

Environmental health principles, international trends and protocols.

Factors and process leading to the emergence of the concept of sustainable development.

Multidisciplinary roles in environmental health.

## Public health and epidemiology

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the meaning and functions of public and environmental health
- understand the basics of the etiology of disease; and
- develop an appreciation of methodologies for investigating and controlling disease.

### *Module content*

Definitions and perception of public health.

National and international development of public health.

Prevention and control measures.

Determinants of public health and social implications.

Identification of populations at risk.

National and international public health aims.

Principles of descriptive and analytical epidemiology.

Surveillance methodologies.

Control of communicable and noncommunicable diseases.

# OPTIONAL MODULES

## Advanced food quality and safety

### *Prerequisites*

Food quality and safety module.

### *Learning objectives*

To enable students to:

- understand the significance and mechanisms of food inspection, and be able to carry out this function;
- develop the skill of assessing risk in the food environment and producing recommendations to reduce this risk; and
- develop effective communication skills appropriate to different audiences in the food production chain.

### *Module content*

Food safety and quality inspection techniques.

Characteristics of environment in which food is produced.

Pest and vector control.

Auditing of food processing techniques.

Legal enforcement framework; codes of practice.

Identification of critical control points and introduction to food industry systems for food quality and hygiene.

## Advanced human habitation

### *Prerequisites*

Human habitation module.

### *Learning objectives*

To enable students to:

- develop the skills necessary to carry out surveys and inspections of various types of habitation;
- develop an understanding of the application of statutory and other standards for housing conditions; and
- appreciate various courses of action for improving substandard housing.

### *Module content*

Recognition of major defects affecting the physical integrity of housing and their significance for public health.

Housing surveys: types and techniques.

Inspection procedures.

Legal and administrative framework.

## Advanced occupational health and safety

*Prerequisites*
Occupational health and safety module.

*Learning objectives*
To enable students to:

- participate in the auditing of health and safety and accident investigation procedures; and
- participate in working with workers' representatives in health promotion activities in the workplace.

*Module content*
Role of interested parties in safety management.
Safety communication skills.
Safety auditing techniques.
Accident investigation techniques.

## Advanced water sciences

*Prerequisites*
Water sciences module.

*Learning objectives*
To enable students to:

- develop analytical and evaluative skills in assessing water quality; and
- enhance their technical knowledge of the control of water pollution from waste treatment plants.

*Module content*
Methods of assessing the potability of the water supply.
Quality criteria.
Water treatment technologies.
Legal and administrative frameworks.
Wastewater treatment and analysis technologies.

## Advanced atmospheric and meteorological sciences

### *Prerequisites*

Atmospheric and meteorological sciences.

### *Learning objectives*

To enable students to:

- increase their understanding of contemporary air pollution issues;
- acquire skills in methods used for monitoring air pollution; and
- develop an understanding of air pollution control strategies.

### *Module content*

Contribution of stationary and mobile sources to ambient pollution levels.
Energy efficiency and air pollution.
Air quality monitoring methodologies.
Emission monitoring techniques.

*Annex 2*

# Detailed Curriculum for General Technicians/Aides

## BASIC MODULES

### Environmental biological sciences

*Prerequisites*

Biological sciences or equivalent.

*Learning objective*

To enable students to review their understanding of the fundamental biological and ecological concepts and reinforce their environmental significance.

*Module content*

Review of basic biological concepts.
Microbiology: origins and methods.
Contemporary classification of bacteria, fungi, moulds and viruses.
Pathogens: environmental risk factors; evaluation of risk factors.
Parasitology.
Entomology.
Control of microbial growth: principles and methodologies.
Industrial and medical applications.

### Environmental physical sciences

*Prerequisites*

Physical sciences or equivalent.

### *Learning objectives*

To enable students to:

- review their understanding of the fundamental concepts of the physical and chemical sciences;
- consolidate their understanding of the function and application of instrumentation for environmental measurement;
- consolidate skills to enable them to undertake simple laboratory techniques and interpret results; and
- understand the relationship between the concepts of physical and chemical sciences to environment and health.

### *Module content*

Physics: review of basic concepts.
Chemistry: review of basic concepts.

## Information sciences

### *Prerequisites*

Background in statistics, information sciences, communications or equivalent.

### *Learning objectives*

To enable students to:

- consolidate their knowledge of the principal statistical methods;
- develop an understanding of data analysis and presentation techniques;
- develop an understanding of how to undertake a research project;
- update their experience of relevant information technology applications, and
- broaden their communication skills appropriate to a wide range of situations.

### *Module content*

Review of statistical principles.
Review of current information technology applications.
Professional communication techniques.

## Social sciences

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- review the basic concepts of psychology and sociology;
- consolidate their understanding of the basic social, economic and political concepts and factors;
- develop an awareness of the relationship between economics, society and government; and
- develop an understanding of the management of the environment and health sectors.

*Module content*
Review of basic sociology.
Social economics: macroeconomic principles and trends; competing theories of government and state.
Public and private sector models.
Health and environmental economics.
Ethics in health.

## Legal and administrative studies

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- develop an awareness of the influence of natural and constitutional justice underlying the legal system;
- gain an understanding of the mechanics of the legal system; and
- acquire a foundation of legal knowledge sufficient for later and more advanced applications.

*Module content*
Review of the type, origin and purpose of national and international law.

Review of national and international legal systems.
Judiciary and legal professions.
Principles of constitutional and administrative law.
Rules of evidence.
Framework of environment and health legislation at subnational, national and international levels.

### Building and construction technology

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- review their understanding of the principles of building technology;
- review the relationship of internal environments to building structure and fabric;
- understand the properties of building materials and their effects in building design and construction; and
- appreciate the factors involved in degradation of buildings.

*Module content*
Site preparation and investigation.
Building fabric characteristics.
Review of building components, fittings and finishes, and services.
Construction systems.
Fire protection

## APPLIED MODULES

### Food quality and safety

*Prerequisites*
Environmental biology.

*Learning objectives*
To enable students to:

- review their understanding of the characteristics of food commodities;
- review their understanding of the causes of foodborne disease and the methods by which it can be prevented;
- appreciate the principles of food hygiene and safety and their application in ensuring a safe food supply; and
- appreciate the common pathological conditions affecting animals in the human food chain.

### *Module content*

Food biochemistry: classification, structure and functionality of living matter; cell structure and metabolism; biochemical nature of food commodities; concepts in nutrition.

Food microbiology: microbiological ecology; associated food risks, food pathogens and spoilage organisms; microbiological aspects of food production and preservation.

Food hygiene and food standards: food safety control; legislative and regulatory controls; foodborne illness; operational hygiene controls and systems, including HACCP.

## Human habitation

### *Prerequisites*

Building and construction technology.

### *Learning objectives*

To enable students to:

- review housing and urban strategies;
- appreciate the relationship between housing and habitation patterns on the one hand and health and wellbeing on the other; and
- understand the basis for determining courses of action for improving habitation standards.

### *Module content*

Types and determinants of and trends in human habitation.

Relationship between habitation, health and wellbeing.

Review of design and construction criteria for habitations.

Fitness assessment of human habitation.

## Occupational health and safety

### *Prerequisites*

Basic course modules or equivalent.

### *Learning objectives*

To enable students to:

- recognize and evaluate hazards and to control risks in the workplace;
- understand monitoring strategies and the interpretation of results;
- appreciate the role of ergonomics in improving health and safety performance; and
- review the principles of occupational health and hygiene and the legal framework for ensuring compliance with occupational health and safety standards.

### *Module content*

Concepts of occupational health and safety.

Occupationally related causes of mortality and morbidity.

Identification, assessment and measurement of hazards and risks.

Specific risk assessment: fire; explosion; noise; vibration; physical environment.

Workplace design.

Legislative control.

Health promotion in the workplace.

## Water sciences

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- review the principles and mechanisms of the water cycle;
- appreciate the principles for the conservation and protection of water resources;
- appreciate the principles for water extraction and exploitation; and

- appreciate the importance of water quality to environmental health status.

### *Module content*

Hydrology: hydrometeorology; hydrological cycle; hydrological balance; water chemistry.
Water demand: water course systems; protection of water sources.
Hydrogeology: physical and chemical characteristics of aquifers; detection and sampling methods for groundwater.
Drinking-water supply: sources; supply; protection.
Public health aspects of water supply and protection.
Water usage for recreational and other uses.

## Soil pollution

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand basic geological and soil science principles; and
- appreciate the basic mechanics of soil pollution and its relationship with the pollution of other media.

### *Module content*

Review of geological principles and mechanisms.
Review of soil sciences.
Soil and water pollution and associated health risks.

## *Atmospheric and meteorological sciences*

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- review the principles of meteorology and atmospheric dispersion;

- gain knowledge of the parameters used to describe air quality;
- appreciate the importance of air quality to environmental health status; and
- understand the physical principles involved in monitoring and controlling atmospheric pollutants.

### *Module content*

Basic meteorology.
Atmospheric dispersion.
Emission sources.
Impact of atmospheric pollutants on air quality, human health, etc.
Air pollution monitoring techniques.

## Noise and acoustics

### *Prerequisites*

Physical sciences.

### *Learning objectives*

To enable students to:

- review the physical properties of sound;
- appreciate the effects of exposure to noise in a variety of settings;
- be aware of the factors influencing the propagation of noise; and
- be able to use noise measuring techniques and interpret results.

### *Module content*

Sound properties and measurement.
Human hearing mechanisms.
Sources of noise propagation.
Assessment procedures and equipment.
Attenuation/control measures and design.

## Radiological safety

### *Prerequisites*

Physical sciences.

### *Learning objectives*

To enable students to:

- understand the physics of radiation within environmental contexts;
- appreciate the biological effects of radiation exposure; and
- gain a working knowledge of analytical and quantitative techniques employed in environmental monitoring and control.

### *Module content*

Review of the nature and characteristics of ionizing and nonionizing radiation.

Sources of exposure to ionizing and nonionizing radiation.

Biological effects of ionizing and nonionizing radiation.

Measurement techniques and instruments.

Principles and methodologies for protection from ionizing and nonionizing radiation.

## INTEGRATED MODULES

### Practical/on-the-job professional training

See the module for Environmental Health Technicians/Aides, page 98.

### Case study

See the module for Environmental Health Technicians/Aides, page 98.

### Toxicology

### *Prerequisites*

Biological and physical sciences.

### *Learning objectives*

To enable students to:

- understand the forms, mechanisms and manifestations of toxic risk; and
- appreciate the various strategies for preventing and reducing toxic risks.

*Module content*

Basic toxicology: biological monitoring; variety of toxicant effects.

Occupational toxicology of metals, gases, solvents, pesticides and dust.

Biohazards.

### Laboratory techniques

See the module for Environmental Health Technicians/Aides, page 99.

## HOLISTIC MODULES

### Environmental health education and promotion

See the module for Environmental Health Technicians/Aides, page 100.

### Environmental health studies

See the module for Environmental Health Technicians/Aides, page 100.

### Public health and epidemiology

See the module for Environmental Health Technicians/Aides, page 101.

## OPTIONAL MODULES

### Advanced food quality and safety

See the module for Environmental Health Technicians/Aides, page 101.

### Advanced human habitation

See the module for Environmental Health Technicians/Aides, page 102.

### Advanced occupational health and safety

See the module for Environmental Health Technicians/Aides, page 103.

### Advanced water sciences

See the module for Environmental Health Technicians/Aides, page 103.

### Advanced atmospheric and meteorological sciences

See the module for Environmental Health Technicians/Aides, page 104.

*Annex 3*

# Detailed Curriculum for Specialist Environmental Health Professionals

## BASIC MODULES

### Biological sciences

*Prerequisites*
Secondary school level science subject.

*Learning objectives*
To enable students to:

- demonstrate an understanding of the fundamental biological and ecological concepts and an appreciation of their environmental significance;
- describe and understand the diversity of life;
- develop an appreciation of both the beneficial and harmful effects of various groups of microorganisms; and
- develop skills to conduct investigations and to interpret and evaluate results.

*Module content*
Cellular biology.
Basic biochemistry.
Taxonomy.
Energetics.
Vital life processes.

Histology.
Genetics.
Evolution and speciation.
Human physiology.
Ecology: ecological systems; indicators; equilibrium.
Human ecology.
Microbiology: origins and methods.
Contemporary classification of bacteria, fungi, moulds and viruses.
Pathogens: toxicity and invasiveness; modes of transmission of disease; environmental risk factors; evaluation of risk factors; bacterial pathogens; viruses of human and animal origin.
Parasitology.
Entomology.
Control of microbial growth: principles and methodologies.
Industrial and medical applications.

## Physical sciences

### *Prerequisites*

Secondary school level science subject and mathematics.

### *Learning objectives*

To enable students to:

- demonstrate an understanding of the fundamental concepts of the physical and chemical sciences;
- understand the function and application of instrumentation for environmental measurement;
- develop the skills to enable them to undertake simple laboratory techniques and interpret results; and
- understand the relationship between the concepts of physical sciences and environment and health.

### *Module content*

Physics: mechanics; properties of solids, liquids and gases, heat, vibration and waves; electricity; electron energy states; lasers (wave/particle quality); atomic physics.
Chemistry: atomic and molecular theory; properties of organic and inorganic compounds; chemical reactions; stoichiometry;

thermochemistry; electrochemistry; applied chemistry; advanced analytical techniques and applications.

## Information sciences

### *Prerequisites*

Secondary school level science subject and mathematics.

### *Learning objectives*

To enable students to:

- gain a working knowledge of the principal methods for the statistical description and analysis of observed data;
- gain an understanding of data analysis and presentation techniques;
- obtain an introduction to developing research projects;
- become familiar with the concepts of computing and with practical experience of relevant information technology applications;
- gain an understanding of the importance of developing communication skills;
- gain an understanding of the various means available for effective communication; and
- develop communication skills appropriate to a wide range of situations.

### *Module content*

Statistics: data collection, presentation of data and sampling techniques; frequency distribution; correlation; regression analysis; probability; calculus; health and social statistics.

Information technology: word processing; spreadsheets and databases; integrated office-based systems; data analysis systems; peripherals; networking (lan/wan applications); introduction to mathematical modelling.

Communications: principles and systems; methods of communication; barriers to communication; professional communication techniques; dealing with mass media communication.

## Social sciences

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- gain an understanding of the basic concepts of psychology and sociology;
- gain an understanding of basic social, economic and political concepts and factors;
- develop an awareness of the relationship between economics, society and government; and
- develop an understanding of the management of the environment and health sectors.

### *Module content*

Psychology: basic concepts; perception; stress; personality; motivation.
Sociology: general introduction; culture; social stratification; influence of technology.
Social economics: macroeconomic principles and trends.
Competing theories of government and state.
Political ideologies.
Fiscal policy and economic management.
Public and private sector models.
Introduction to health and environmental economics.
Ethics in health.

## Legal and administrative studies

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- develop an awareness of the influence of natural and constitutional justice underlying the legal system;
- gain an understanding of the mechanics of the legal system; and
- acquire a foundation of legal knowledge sufficient for later and more advanced applications.

### *Module content*

Type, origin and purpose of national and international law.

National and international legal systems.
Judiciary and legal professions.
Principles of constitutional and administrative law.
Rules of evidence.
Framework of environment and health legislation at subnational, national and international levels.
Administration of public and private health, environmental and economic sectors.
International relations and cooperation.

## Building and construction technology

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- develop an understanding of the principles of building technology;
- appreciate the relationship of internal environments to building structure and fabric;
- understand the properties of building materials and their effects on building design and construction;
- understand the factors involved in degradation of buildings; and
- appreciate the legal and economic factors involved in building development and maintenance.

### *Module content*

Site preparation and investigation..
Building fabric characteristics.
Building components: walls, floors, roofing, stairs, etc:
Design and construction criteria.
Building fittings and finishes.
Building services: ventilation, lighting, heating, etc.
Construction systems.
Fire protection.
Building maintenance and repair.
Construction failure: principles, identification and corrective action.
Economics of maintenance.
Energy audits and conservation.

## APPLIED MODULES

### Food quality and safety

*Prerequisites*
Biology.

*Learning objectives*
To enable students to:

- develop an understanding of the characteristics of food commodities;
- develop an understanding of the causes of foodborne disease and the methods by which it can be prevented;
- appreciate the principles of food hygiene and safety and their application in ensuring a safe food supply;
- appreciate the common pathological conditions affecting animals in the human food chain; and
- develop an understanding of the requirements for coordinating and controlling hygiene and safety in the food chain.

*Module content*
Food biochemistry: classification, structure and functionality of living matter; cell structure and metabolism; biochemical nature of food commodities; concepts in nutrition.

Food microbiology: microbiological ecology; associated health risks, food pathogens and spoilage organisms; microbiological aspects of food production and preservation; food technology and processing; quality assurance management.

Food hygiene and food safety: legislative and regulatory controls; enforcement and compliance strategies; food standards; foodborne illness; operational hygiene controls; quality management systems; HACCP and ISO standards.

### Human habitation

*Prerequisites*
Building and construction technology.

### *Learning objectives*

To enable students to:

- understand the rationale for developing housing and urban strategies;
- appreciate the relationship between housing and habitation patterns on the one hand and health and wellbeing on the other;
- understand the basis for determining courses of action for improving habitation standards; and
- understand the roles of the main actors in developing and implementing housing policy.

### *Module content*

Types and determinants of and trends in human habitation.
Relationship between habitation, health and wellbeing.
Housing policy in terms of physical, mental and social wellbeing.
Open-space planning and urban development.
Design and construction criteria for habitations.
Habitation criteria for populations with special needs.
Fitness assessment of housing.

## Occupational health and safety

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- recognize and evaluate hazards and control risks arising from physical, chemical and biological agents in the workplace;
- understand the concepts of accident causation and investigation;
- understand monitoring strategies and the interpretation of results;
- appreciate the role of ergonomics in improving health and safety performance;
- understand the principles of occupational health and hygiene and the legal framework for ensuring compliance with occupational health and safety standards;

- understand and appreciate the main components of a risk management system in the workplace and evaluate its application to the management of safety in the workplace; and
- develop training skills for improving safety performance at the workplace.

### *Module content*

Concepts of occupational health and safety.

Occupationally related causes of mortality and morbidity.

Identification, assessment and measurement of hazards and risks.

Prevention and control of specific risks: fire, explosion, noise, vibration, the physical environment, chemical agents, etc.

Workplace design.

Protective equipment.

Legislative control.

Safety auditing and management systems.

Developing health promotion in the workplace: strategies and organization.

## Water sciences

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the principles and mechanisms of the water cycle;
- appreciate the principles for the conservation and protection of water resources;
- appreciate the importance of water quality to environmental health status
- appreciate the principles of water extraction and exploitation; and
- appreciate the legal and administrative framework for the protection and conservation of water sources.

### *Module content*

Hydrology: hydrometeorology; the hydrological cycle; hydrological balance.

Water chemistry.
Water demand.
Water course systems.
Measurement techniques.
Protection of water sources.
Physical and chemical characteristics of aquifers.
Detection and sampling methods for groundwater.
Groundwater flow modelling.
Protection of aquifers.
Public health aspects of water supply and protection.
Drinking-water: sources, supply; protection.
Wastewater treatment technologies.
Water use for recreational and other purposes.
Legal and other aspects of water quality.

## Radiological safety

### *Prerequisites*

Physical sciences.

### *Learning objectives*

To enable students to:

- understand the physics of radiation within environmental contexts;
- appreciate the biological effects of radiation exposure;
- gain a working knowledge of analytical and quantitative techniques employed in environmental monitoring and control; and
- appreciate the different systems for the prevention and control of risk from ionizing and nonionizing radiation.

### *Module content*

Review of the nature and characteristics of ionizing and nonionizing radiation.
Biological effects of ionizing and nonionizing radiation.
Interaction of ionizing radiation with matter.
Natural and man-made sources of radiation: industrial, medical and other uses.
Measurement techniques and instruments.
Treatment and disposal of radioactive wastes: criteria, codes, and standards.

Principles and methodologies of protection from ionizing and nonionizing radiation.

## Land-use planning

### *Prerequisites*

Building and construction technology, and legal and administrative studies.

### *Learning objectives*

To enable students to:

- develop a critical understanding of the development of land-use planning and its importance in environmental health; and
- appreciate the intersectoral concerns in developing sustainable land-use policies.

### *Module content*

Evolution of land-use planning.
Relationship between land-use planning, environment and health.
Political and social framework of land-use planning.
Land-use planning approaches and methodologies.
Land preservation, conservation and reclamation.
Urban and rural planning.
Introduction to environmental impact assessment.

## Organizational management

### *Prerequisites*

Social sciences, and legal and administrative studies.

### *Learning objectives*

To enable students to:

- understand the basic principles of management as developed by several schools of thought;
- become familiar with the concepts and techniques of management science and their application; and
- develop an understanding of public and private sector administration.

### *Module content*

Evolution of schools of thought.

Management theory and science.
Management functions.
Organizational systems.
Social systems.
Trends in management and organization.
National administration of environmental health.
Legislative systems and organization.
Evolution of national public and private sector organizations and institutions.

## Noise and acoustics

### *Prerequisites*

Physical sciences.

### *Learning objectives*

To enable students to:

- understand the physical properties of sound;
- appreciate the effects of exposure to noise in a variety of settings;
- be aware of the factors influencing the propagation of noise;
- be able to use noise-measuring techniques and interpret results; and
- understand and be able to assess likely individual and community reactions to noise.

### *Module content*

Sound properties and measurement.
Human hearing mechanisms.
Sources and propagation of noise.
Assessment procedures and equipment.
Attenuation/control measures and design.
Community response to noise.

## Soil pollution

### *Prerequisites*

Biological and physical sciences.

### *Learning objectives*

To enable students to:

- understand the basic principles of geology and soil science; and
- appreciate the basic mechanics of soil pollution and its relationship with pollution of other media.

### *Module content*

Review of geological principles and mechanisms.
Soil sciences: biochemistry; microbiology; mineralogy.
Classification of soils and geomorphology.
Soil/water/plant interactions.
Biotransformation.
Soil and water pollution and associated effects.

## Atmospheric and meteorological sciences

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the principles of meteorology and atmospheric dispersion;
- develop in-depth knowledge of the parameters used to describe air quality;
- appreciate the importance of water quality to environmental health status;
- understand the physical principles involved in monitoring and controlling atmospheric pollutants; and
- appreciate the legal and administrative framework for air quality management.

### *Module content*

Basic meteorology.
Atmospheric dispersion.
Emission sources.
Primary and secondary pollutant characteristics and formation.

Impact of atmospheric pollutants on air quality, human health, etc.
Air pollution monitoring techniques.
Air pollution control technology.
Air quality management techniques.

## Applied linguistics

### *Prerequisites*

Secondary school level in a relevant second language.

### *Learning objective*

To enable students to communicate verbally and in writing with fellow professionals in a relevant second language.

### *Module content*

Review of fundamentals of language structure.
Comprehension and formulation of oral and written communications.
Practice in various means of communication: phone, fax, meetings, etc.
Review of technical documents and applied vocabulary.

## INTEGRATED MODULES

## Practical/on-the-job professional training

The organization of this module depends on national and subnational needs and resources.

### *Learning objectives*

To enable students to:

- have an opportunity to utilize and develop competences acquired in the academic courses;
- gain experience of working in a professional environment as a member of a team;
- develop an understanding of the functions and responsibilities of and the interrelationships between the various agencies of an environmental health service; and
- benefit from the expertise of those already engaged in environmental health services.

## Project dissertation

*Prerequisites*
Research techniques.

*Learning objectives*
To enable students to:

- demonstrate their critical and analytical abilities through a focused, in-depth study;
- deploy project management and investigative skills and methodologies; and
- deploy written and oral communication skills.

## Risk management

*Prerequisites*
Basic and applied modules.

*Learning objectives*
To enable students to:

- understand the stages involved in risk evaluation;
- appreciate the importance of risk and the different forms of exposure;
- understand the broad principles of risk management;
- identify parameters utilized in devising risk management policies;
- appreciate risk management strategies and interventions.

*Module content*
Principles of "hazard", "risk" and risk evaluation.
Estimation of risk exposure and its application.
Risk characterization and acceptability.
Risk management principles and practices in different scenarios.

## Multimedia pollution control

*Prerequisites*
Applied modules.

### *Learning objectives*

To enable students to:

- understand the interrelationships between various pollution sources and exposure pathways;
- appreciate the necessity for an integrated approach to pollution prevention and control; and
- develop an overview of strategies for implementing integrated pollution control.

### *Module content*

Global and local trends in pollution.
Mechanisms, sources and risk assessment of multimedia pollution.
Integrated pollution control concepts and techniques.

## Waste management

### *Prerequisites*

Applied modules.

### *Learning objectives*

To enable students to:

- consolidate their knowledge of the sources, nature and quantity of waste produced nationally and internationally;
- appreciate the environmental and public health significance of waste generation;
- understand the technologies available for dealing with waste; and
- appreciate the principles and practice of waste avoidance.

### *Module content*

Wastewater sources and characteristics.
Treatment systems: principles; types; appropriateness; design and loading criteria.
Legal and administrative procedures.
Origins and constituents of solid waste.
Collection, transfer and disposal of solid waste.
Hazardous wastes and their disposal.
Health and environmental implications.

Waste management strategies: waste reduction and recycling strategies, heat-to-energy techniques.

Application of integrated pollution control techniques.

## Toxicology

### *Prerequisites*

Biological and physical sciences.

### *Learning objectives*

To enable students to:

- understand the forms, mechanisms and manifestations of toxic risk;
- appreciate the various strategies for preventing and reducing toxic risk; and
- apply the results of toxicity tests to the development of strategies for reducing exposure to toxic risk.

### *Module content*

Basic toxicology: mechanisms of toxic action; modifying factors; metabolism; storage and excretion; target sites; acute and chronic action; pathological effect.

Toxiometrics.

Biological monitoring.

Variety of toxicant effects.

Occupational toxicology of metals, gases, solvents, pesticides and dust.

Biohazards.

Chemical safety management.

Management of toxic risks in the environment.

## Safety and emergency management

### *Prerequisites*

Risk management.

### *Learning objectives*

To enable students to:

- develop an understanding of the application of expertise gained in emergency situations; and
- appreciate the interdisciplinary nature of emergency preparedness.

*Module content*

Concepts of accident causation and predisposing factors.
Emergency preparedness strategies and planning.
Concepts of response to emergencies and accidents.
Investigation of accidents.

## Vector control

*Prerequisites*

Biological sciences.

*Learning objective*

To enable students to gain a thorough overview of the principles and practices of vector control.

*Module content*

Identification, life histories and control of the main vectors.
Environmental and public health significance of the main vectors.
Means of detection and treatment.
Vector control measures.

## Research techniques

*Prerequisites*

Basic course modules.

*Learning objective*

To enable students to become acquainted with basic research principles and techniques.

*Module content*

Characteristics, principles and nature of qualitative and quantitative research.
Application of research techniques and their utilization.
Presentation of research findings and conclusions.

## HOLISTIC MODULES

### Environmental health education and promotion

*Prerequisites*
Public health and information sciences.

*Learning objectives*
To enable students to:

- explore the concepts, role and situations of health promotion within the context of environmental health; and
- develop and consolidate the skills required to be an effective health promoter and educator within the context of their professional work.

*Module content*
Philosophies and methodologies.
Educational techniques and forums.
Behavioural change and health education at personal and community levels.
Educational programme design for target audiences.
Health promotion concepts.
Developing and running health promotion campaigns.

### Environmental health studies

*Prerequisites*
Basic course modules and public health.

*Learning objectives*
To enable students to:

- develop an awareness of the interdisciplinary nature of environmental health issues;
- gain an enhanced overview of the holistic nature of environmental health and the application of holistic approaches to dealing with issues; and
- gain experience in problem-solving in relation to environmental health issues.

### *Module content*

The emergence of the environmental movement.

Evolution of environmental health from national and international perspectives.

Environmental health principles: international trends and protocols.

Transfrontier pollution control.

The economics of pollution.

The factors and processes leading to the emergence of sustainable development concepts.

Practical applications of the multidisciplinary role in environmental health.

## Public health and epidemiology

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the meaning and functions of public and environmental health;
- understand the basics of the etiology of disease;
- develop an appreciation of methodologies for investigating and controlling disease;
- develop an understanding of the ideologies and models that underpin public health;
- appreciate the nature of personal and social influences on the outcomes of health promotion; and
- develop relevant skills for intersectoral collaboration in health promotion.

### *Module content*

Definitions and perception of public health.

National and international development of public health.

Prevention and control measures.

Identification of populations at risk.

Determinants of public health and its social implications.

Ethical and political considerations.

Public health research.

National and international public health targets.
Principles of descriptive and analytical epidemiology.
Surveillance methodologies.
Control of communicable and noncommunicable diseases.
Statistical methods in assessment of risk factors.
Epidemiological investigation methods.

## OPTIONAL MODULES

### Environmental engineering

*Prerequisites*
Basic and applied course modules.

*Learning objective*
To enable students to consolidate and synthesize their knowledge and awareness of aspects of engineering relevant to environmental health.

*Module content*
Mathematics: revision of basic principles.
Applied engineering computation.
Engineering economics.
Principles of applied engineering.
Transportation studies.

### Environmental health impact assessment and auditing

*Prerequisites*
Basic and applied course modules, risk management, public health and environmental health studies.

*Learning objectives*
To enable students to:

- understand the techniques and application of environmental health impact assessment; and
- consolidate understanding from a wide range of individual course modules

### *Module content*

Evolution of environmental health impact assessment.

Means of developing, implementing and monitoring environmental health impact assessment.

Development of environmental auditing and management systems.

Accreditation and self-regulation in environmental health management.

*Annex 4*

# Detailed Curriculum for Other Specialist Professionals

## BASIC MODULES

### Information sciences

*Prerequisites*

Course entry requirements.

*Learning objectives*

To enable students to:

- consolidate their knowledge and understanding of data analysis and presentation techniques;
- update their experience of relevant information technology applications; and
- develop communication skills appropriate to a wide range of situations.

*Module content*

Review of statistics.
Health and social statistics.
Information technology applications.
Introduction to mathematical modelling.
Review of communications principles.
Professional communication techniques.
Dealing with mass media communication.

## Social sciences

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- consolidate their understanding of the basic concepts of psychology and sociology;
- consolidate their awareness of the relationship between economics, society and government; and
- gain an understanding of the management of the environment and health sectors.

### *Module content*

Review of psychology and sociology.
Review of social economics.
Fiscal policy and economic management.
Public and private sector models.
Health and environmental economics.
Ethics in health.

## Legal and administrative studies

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- develop an awareness of the influence of natural and constitutional justice underlying the legal system
- gain an understanding of the mechanics of the legal system; and
- acquire a foundation of legal knowledge sufficient for later and more advanced applications.

### *Module content*

Review of national and international law.

National and international legal systems.
Principles of constitutional and administrative law.
Rules of evidence.
Framework of environment and health legislation at subnational, national and international levels.
Administration of public and private health, environmental and economic sectors.
International relations and cooperation.

## Building and construction technology

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- develop an understanding of the principles of building technology;
- appreciate the relationship of internal environments to building structure and fabric; and
- appreciate legal and economic factors involved in building development and maintenance.

### *Module content*

Review of building principles, components and services.
Construction systems.
Fire protection.
Building maintenance and repair.
Construction failure: principles, identification and corrective action.
Economics of maintenance.
Energy audits and conservation.

# APPLIED MODULES

## Food quality and safety

### *Prerequisites*

Biological sciences.

### *Learning objectives*

To enable students to:

- consolidate their understanding of the characteristics of food commodities and the causes of foodborne disease and the methods by which it can be prevented;
- appreciate the principles of food hygiene and safety and their application in ensuring a safe food supply;
- review common pathological conditions affecting animals in the human food chain; and
- develop an understanding of the requirements for coordinating and controlling hygiene and safety in the food chain.

### *Module content*

Food biochemistry and microbiology, including associated health risks.
Food production and preservation.
Food technology and processing.
Quality assurance management.
Food hygiene, food safety control and food standards.
Legislative and regulatory controls.
Enforcement and compliance strategies.
Operational hygiene controls.
Quality management systems and ISO standards.

## Human habitation

### *Prerequisites*

Building and construction technology or equivalent.

### *Learning objectives*

To enable students to:

- understand the rationale for developing housing and urban strategies;
- appreciate the relationship between housing and habitation patterns on the one hand and health and wellbeing on the other;
- understand the basis for determining courses of action for improving habitation standards; and
- understand the role of the main actors in developing and implementing housing policy.

### *Module content*

Human habitation and its relationship to health and wellbeing.
Housing policy: open-space planning and urban development.
Design and construction criteria for habitations.
Habitation criteria for populations with special needs.
Fitness assessment of housing.

## Occupational health and safety

### *Prerequisites*

Basic course modules or equivalent.

### *Learning objectives*

To enable students to:

- consolidate their knowledge of the management of hazards and the control of risks arising from physical, chemical and biological agents in the workplace;
- understand the concepts of accident causation and investigation;
- understand monitoring strategies and the interpretation of results;
- appreciate the role of ergonomics in improving health and safety performance;
- understand the principles of occupational health and hygiene and the legal framework for ensuring compliance with occupational health and safety standards;
- understand and appreciate the main components of a risk management system in the workplace and evaluate its application to the management of safety in the workplace; and
- consolidate training skills for improving safety at the workplace.

### *Module content*

Concepts of occupational health and safety.
Occupationally related causes of mortality and morbidity.
Identification, assessment and measurement of hazards and risks.
Prevention and control of specific risks: fire, explosion, noise, vibration, the physical environment, chemical agents, etc.
Workplace design.
Protective equipment.

Legislative control.
Safety auditing and management systems.
Developing health promotion in the workplace: strategies and organization.

## Water sciences

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- consolidate their knowledge of the water cycle;
- consolidate their knowledge of the principles of the conservation, protection and exploitation of water resources;
- appreciate the importance of water quality to environmental health status; and
- develop awareness of the legal and administrative framework for the protection and conservation of water sources.

### *Module content*

The hydrological cycle.
Water demand.
Water course systems.
Measurement techniques.
Protection of water sources.
Physical and chemical characteristics of aquifers.
Detection and sampling methods for groundwater.
Groundwater flow modelling.
Protection of aquifers.
Public health aspects of water supply and protection.
Drinking-water: sources, supply; protection.
Wastewater treatment technologies.
Water use for recreational and other purposes.
Legal and other aspects of water quality.

## Radiological safety

### *Prerequisites*

Course entry requirements.

### Learning objectives

To enable students to:

- consolidate their understanding of the physics of radiation within environmental contexts;
- gain a working knowledge of analytical and quantitative techniques employed in environmental monitoring and control; and
- appreciate the different systems for the prevention and control of risk from ionizing and nonionizing radiation.

### Module content

Review of the nature and characteristics of ionizing and nonionizing radiation and its effects.

Natural and man-made sources of radiation: industrial, medical and other uses.

Measurement techniques and instruments.

Treatment and disposal of radioactive wastes: criteria, codes and standards.

Principles and methodologies for protection from ionizing and nonionizing radiation.

## Land-use planning

### Prerequisites

Building and construction technology, and legal and administrative studies or equivalent.

### Learning objectives

To enable students to:

- develop a critical understanding of the development of land-use planning and its importance in environmental health; and
- appreciate the intersectoral concerns in developing sustainable land-use policies.

### Module content

Relationship between land-use planning, environment and health.

Political and social framework of land-use planning.

Land-use planning approaches and methodologies.

Land preservation, conservation and reclamation.

Urban and rural planning.
Introduction to environmental impact assessment.

### Noise and acoustics

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- understand the physical properties of sound and the effects of exposure to noise in a variety of settings;
- be aware of the factors influencing the propagation of noise;
- be able to use noise-measuring techniques and interpret results; and
- understand and be able to assess likely individual and community reaction to noise.

*Module content*
Sound properties and measurement.
Human hearing mechanisms.
Sources and propagation of noise.
Assessment procedures and equipment.
Attenuation/control measures and design.
Community response to noise.

### Soil pollution

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- understand the basic principles of geology and soil science; and
- appreciate the basic mechanics of soil pollution and its relationship with pollution of other media.

*Module content*
Review of geological principles and mechanisms.

Review of soil sciences.
Soil/water/plant interactions.
Biotransformation.
Soil and water pollution.

## Atmospheric and meteorological sciences

### *Prerequisites*

Basic course modules.

### *Learning objectives*

To enable students to:

- understand the principles of meteorology and atmospheric dispersion;
- appreciate the importance of air quality to environmental health status;
- develop knowledge of the parameters used to describe air quality;
- consolidate understanding of the physical principles involved in monitoring and controlling atmospheric pollutants; and
- appreciate the legal and administrative framework for air quality management.

### *Module content*

Review of meteorology and atmospheric dispersion.
Atmospheric emission sources.
Primary and secondary pollutant characteristics and formation.
Impact of atmospheric pollutants on air quality, human health, etc.
Air pollution monitoring techniques.
Air pollution control technology.
Air quality management techniques.

## Applied linguistics

### *Prerequisites*

Basic linguistic competence in a relevant second language.

### *Learning objective*

To enable students to consolidate their linguistic skills for professional communication in a relevant second language.

### *Module content*

Review of comprehension and formulation of oral and written communication.

Practice in various means of communication: phone, fax , meetings, etc.

Review of technical documents and applied vocabulary.

## INTEGRATED MODULES

### Practical/on-the-job professional training

The organization of this module depends on national and subnational needs and resources.

### *Learning objectives*

To enable students to:

- have an opportunity to consolidate competences acquired in the academic courses;
- gain experience of adapting their expertise to the field of environmental health by working in a professional environment as a member of a team;
- develop an appreciation of the functions and responsibilities of and the interrelationships between the various agencies of an environmental health service;
- share their expertise with fellow professionals in a work environment; and
- benefit from the expertise of those already engaged in environmental health services.

### Project dissertation

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- consolidate their critical and analytical abilities through a focused, in-depth study of an environmental health issue; and

- further develop project management and investigative skills and methodologies.

## Risk management

### *Prerequisites*

Basic and applied modules or relevant module equivalent.

### *Learning objectives*

To enable students to:

- understand the stages involved in risk evaluation;
- appreciate the importance of risk and the different forms of exposure;
- understand the broad principles of risk management;
- identify parameters utilised in devising risk management policies; and
- appreciate risk management strategies and interventions.

### *Module content*

Principles of "hazard", "risk" and risk evaluation.
Estimation of risk exposure and its application.
Risk characterization and acceptability.
Risk management principles and practices in different scenarios.

## Multimedia pollution control

### *Prerequisites*

Basic and applied modules or relevant module equivalent.

### *Learning objectives*

To enable students to:

- consolidate their knowledge of the interrelationships between various pollution sources and exposure pathways;
- appreciate the necessity for an integrated approach to pollution prevention and control; and
- develop an overview of strategies for implementing integrated pollution control.

*Module content*

Global and local trends in pollution.
Mechanisms, sources and risk assessment of multimedia pollution.
Integrated pollution control concepts and techniques.

## Waste management

*Prerequisites*

Applied modules.

*Learning objectives*

To enable students to:

- consolidate their knowledge of the sources, nature and quantity of waste produced nationally and internationally;
- appreciate the environmental and public health significance of waste generation;
- consolidate their understanding of the technologies available for dealing with waste; and
- consolidate their understanding of the principles and practice of waste avoidance.

*Module content*

Wastewater sources and characteristics.
Treatment systems: principles, types; appropriateness.
Origins and constituents of solid waste.
Collection, transfer and disposal of solid wastes.
Hazardous wastes and their disposal.
Health and environmental implications of waste management.
Waste management strategies: reduction and recycling strategies; heat-to-energy techniques.
Application of integrated pollution control techniques.

## Environmental health services management

*Prerequisites*

Course entry requirements.

*Learning objectives*

To enable students to:

- consolidate their knowledge of the basic principles of management;
- consolidate their knowledge of the concepts and techniques of management science and their application;
- appreciate public and private sector administration; and
- develop an awareness of the principles of good management practice in environmental health services.

## Toxicology

### *Prerequisites*

Biological and physical sciences.

### *Learning objectives*

To enable students to:

- consolidate their understanding of the forms, mechanisms and manifestations of toxic risk and the various strategies for preventing and reducing toxic risks;
- know how to apply the results of toxicity tests to the development of strategies for reducing exposure to toxic risk.

### *Module content*

Review of basic toxicology: toxiometrics, biological monitoring variety of toxicant effects.

Occupational toxicology of metals, gases, solvents, pesticides, and dust. Biohazards.

Chemical safety management.

Management of toxic risks in the environment.

## Safety and emergency management

### *Prerequisites*

Risk management.

### *Learning objectives*

To enable students to:

- adapt their expertise to deal with emergency situations; and
- appreciate the interdisciplinary nature of emergency preparedness.

#### *Module content*

Concepts of accident causation and predisposing factors.
Emergency preparedness strategies and planning.
Concepts of response to emergencies and accidents.
Investigation of accidents.

### Vector control

#### *Prerequisites*

Course entry requirements.

#### *Learning objective*

To enable students to gain thorough overview of the principles and practices of vector control.

#### *Module content*

Identification, life histories, and control of the main vectors.
Public health significance of the main vectors.
Means of detection and treatment.
Vector control measures.

## HOLISTIC MODULES

### Public health and epidemiology

#### *Prerequisites*

Course entry requirements.

#### *Learning objectives*

To enable students to:

- consolidate their understanding of public and environmental health;
- develop an understanding of the ideologies and models that underpin public health;
- appreciate the nature of personal and social influences on the outcomes of health promotion; and
- develop relevant skills for intersectoral collaboration in health promotion.

### Module content

Review of public health.
Prevention and control measures.
Identification of populations at risk.
Determinants of public health and its social implications.
Ethical and political considerations.
Public health research.
National and international public health targets.
Review principles of descriptive and analytical epidemiology.
Surveillance methodologies.
Control of communicable and noncommunicable diseases.
Statistical methods in assessment of risk factors.
Epidemiological investigation methods.

## Environmental health education and promotion

### Prerequisites

Public health, information sciences or relevant module equivalent.

### Learning objectives

To enable students to:

- explore the concepts, role, and situations of health promotion within the context of environmental health; and
- develop and consolidate the skills required to be effective health promoters and educators within the context of their professional work.

### Module content

Philosophies and methodologies.
Educational techniques and forums.
Behavioural change and health education at personal and community level.
Target audiences: educational programme design.
Health promotion concepts.
Developing and running health promotion campaigns.

## Environmental health studies

### Prerequisites

Basic course modules (or relevant module equivalent) and public health.

### *Learning objectives*

To enable students to:

- increase their awareness of the interdisciplinary nature of environmental health issues;
- gain an enhanced overview of the holistic nature of environmental health and the application of holistic approaches to dealing with issues; and
- gain experience in dealing with problem-solving in relation to environmental health issues.

### *Module content*

The emergence of the environmental movement.

Evolution of environmental health from national and international perspectives.

Environmental health principles: international trends and protocols.

The factors and processes leading to the emergence of sustainable development concepts.

Transfrontier pollution control.

The economics of pollution.

Practical applications of the multidisciplinary role in environmental health.

# OPTIONAL MODULES

## Environmental engineering

### *Prerequisites*

Basic and applied course modules.

### *Learning objective*

To enable students to consolidate and synthesize their knowledge and awareness of aspects of engineering relevant to environmental health.

### *Module content*

Mathematics: revision of basic principles.

Applied engineering computation.

Engineering economics.

Principles of applied engineering.
Transportation studies.

## Environmental health impact assessment and auditing

### *Prerequisites*

Basic and applied course modules, risk management, public health and environmental health studies.

### *Learning objectives*

To enable students to:

- understand the techniques and application of environmental health impact assessment; and
- consolidate understanding from wide range of individual course modules.

### *Module content*

Evolution of environmental health impact assessment.
Means of developing, implementing, and monitoring environmental health impact assessment.
Development of environmental auditing and management systems.
Accreditation and self-regulation in environmental health management.

Annex 5

# Detailed Curriculum for Environmental Health Service Managers

## BASIC MODULES

### Epidemiology

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- develop an overview of the principles of epidemiology; and
- develop the relevant skills for initiating and directing epidemiological investigations and studies.

*Module content*
Principles, scope and uses of epidemiology.
Measures of disease occurrence and patterns of disease in populations.
Investigation and research methodologies and strategies.

### Population and health statistics

*Prerequisites*
Course entry requirements.

### *Learning objectives*

To enable students to:

- become familiar with the main sources of population, mortality and morbidity statistics;
- understand the techniques available for analysing relevant health and population data; and
- gain experience in examining and using statistics in the formulation of policies and strategies.

### *Module content*

Investigation of census and other population data.
Mortality and morbidity statistics.
Data investigation techniques and packages.
Applied statistical research in specific areas of interest.

## Communication sciences

### *Prerequisites*

Course entry requirements.

### *Learning objective*

To enable students to develop communication skills in key areas of management.

### *Module content*

Organization and chairing of meetings.
Preparation and presentation of conference and seminar papers.
Interview and presentation skills for the mass media.

## Environmental health economics

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- consolidate their understanding of economic principles; and
- understand the mechanisms for developing and implementing budgets for environmental health services.

### *Module content*

Review of economic concepts and principles.

Main actors in microeconomic and macroeconomic issues.

Principles for developing and controlling budgets.

## Human resources management

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- understand the principles and concepts of human resources management;
- appreciate current strategies and techniques of human resources management; and
- understand the various roles of managers in the implementation of effective human resources management.

### *Module content*

Principles of human resources management.

Staffing, motivation, job analysis, compensation and industrial relations.

The role of training and development.

Human resources management practices.

## APPLIED MODULES

These modules are seen as providing an opportunity for students to examine current developments and concepts in each of the areas below. As such, these modules share broadly similar sets of learning objectives and content. The modules are:

- water quality management
- air quality management
- food quality management
- occupational health and safety
- human habitation studies

- radiological safety
- land-use management
- safety and emergency management.

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- explore current trends and developments in the relevant areas; and
- carry out critical appraisal of current literature in each of those areas.

### *Module content*

Recent technical developments.
Current topics of concern.
Appraisal of recent scientific and other literature.

## INTEGRATED MODULES

### Toxicology

### *Prerequisites*

Epidemiology.

### *Learning objectives*

To enable students to:

- review the principles of toxicology and the strategies for preventing and reducing toxic risks;
- consolidate their understanding of the management of risks in the environment; and
- consider case studies of particular toxic risk management issues.

### *Module content*

Principles and concepts of toxicology.

Toxic risk evaluation and management.
Examination of relevant national and international issues on toxic risk.
Case studies of particular toxic risk scenarios.

## Risk management

### *Prerequisites*

Epidemiology and toxicology.

### *Learning objectives*

To enable students to:

- consolidate their knowledge and understanding of risk assessment and management concepts;
- understand the application of good risk assessment and management practice to a variety of scenarios;
- appreciate the integral role of risk perception in risk management; and
- appreciate the role of other actors in risk management issues.

### *Module content*

Review of the principles and concepts of risk assessment and management.
Concepts of risk perception.
Risk management partnerships.
Risk management in emergency situations.

## Project management

### *Prerequisites*

Environmental health economics and human resources management.

### *Learning objectives*

To enable students to:

- develop an overview of the issues involved in designing and leading projects;
- develop skills in developing and presenting project proposals; and
- learn skills for leading multidisciplinary project teams.

### Module content

Review of economic concepts and human resources management.
Introduction to project financing.
Project development: concepts, management and project control.
Basics of contractual law.
Team-building and leadership issues.
Aspects of international projects.
Project practice and research.

## Environmental health services management

### Prerequisites

Basic course modules.

### Learning objectives

To enable students to:

- integrate various management and economic components of the course as they apply to environmental health services; and
- appreciate the importance of good management practice in environmental health services.

### Module content

Evolution of national environment and health sectors.
Review of national environmental health services structures and organization.
National and international developments in environmental health.
Leadership issues in general management of the health and environmental sectors.

## Environmental health impact assessment and auditing

### Prerequisites

Basic and applied course modules.

### Learning objectives

To enable students to:

- consolidate their understanding of environmental health impact assessment concepts; and

- investigate the current range of auditing and self-regulatory approaches in environmental health.

### Module content

Evolution and principles of environmental health impact assessment and auditing systems.
Application of "eco-auditing" and "eco-labelling" systems.
International developments in self-regulation mechanisms.
ISO and other international protocols.

## Environmental health policy and legislation

### Prerequisites

Course entry requirements.

### Learning objectives

To enable students to:

- gain an appreciation of the factors contributing to the development of national and international environmental health policy; and
- consolidate their understanding of current national and international environmental health legislation and policy.

### Module content

Overview of philosophical and political foundations for environmental health policy.
Emerging issues, long-term trends and future directions for environmental policy.
Review of current environmental health legislation.
Approaches to and methodologies for drafting legislation.

## Health promotion

### Prerequisites

Health economics and environmental health services management.

### Learning objectives

To enable students to:

- develop an overview of the development of the theories, values and models of health promotion that underpin current practice;

- gain an appreciation of the main themes and models that contribute to the processes involved in health-related behavioural change; and
- gain an understanding of ethical principles and issues relating to health promotion.

### *Module content*

Review of the evolution of health promotion theory and practice.
Models of health promotion.
Health promotion research.
Theories of learning, attitudes, beliefs and values.
Principles of ethics and their relevance to health promotion.

## Environmental health services evaluation

### *Prerequisites*

Environmental health economics, environmental health services management and health promotion.

### *Learning objectives*

To enable students to:

- develop an understanding of the importance of evaluation in the management of environmental health services; and
- gain an appreciation of approaches to evaluating environmental health services.

### *Module content*

Principles and theoretical framework for evaluating environmental health services.
Instruments for evaluation and managing evaluation processes.
Best practice in evaluation.
Role and limitation of evaluation in specific cases in environmental health services.

# OPTIONAL MODULES

## Environmental health education and methodologies

### *Prerequisites*

Health promotion.

### *Learning objectives*

To enable students to:

- gain an understanding of the principles of developing environmental health education programmes; and
- develop practical expertise in educational programme development and implementation.

### *Module content*

Application of teaching and learning methods.
Course design.
Participatory methods in education and training.
Design and assessment of material.
Role of the mass media in health education.
Design and evaluation of programmes.
Examples of good practice.

## Linguistics

### *Prerequisites*

Advanced level in relevant second language.

### *Learning objective*

To enable students to consolidate their ability to deal with technical and professional issues in a relevant second language.

### *Module content*

Critical review of current environmental health literature in a relevant second language.
Conducting and participating in seminars and meetings through a relevant second language.

## Environmental health economics

### *Prerequisites*

Basic course module in environmental health economics.

### *Learning objective*

To enable students to develop an understanding of the concepts of economic evaluation of environmental health services.

### *Module content*

Review of economic concepts and principles.

Economic assessment of environmental health programmes, including cost–effectiveness and cost–benefit analysis.

Examples of good practice.

## Health promotion management

### *Prerequisites*

Health promotion.

### *Learning objectives*

To enable students to:

- develop an appreciation of approaches to health promotion in relation to key settings and issues in society;
- gain knowledge of the opportunities and obstacles that exist in developing health promotion programmes; and
- gain an appreciation of the roles played by the networks of partners involved in health promotion in a variety of settings.

### *Module content*

Identification of key settings and target groups for health promotion.

Review of current approaches to health promotion in society.

Review of the role of networks in health promotion.

Critical appraisal of examples of good practice.

## Human resources management

### *Prerequisites*

Basic course module on human resources management.

### *Learning objectives*

To enable students to:

- review the principles and concepts of human resources management;
- consolidate their understanding of the role of managers in the implementation of effective human resources management; and

- appreciate the importance of the acquisition, development and retention of human resources.

### Module content

Review of the principles of human resources management.
Recruitment and selection procedures, discipline and appraisals.
Managing training and development.
Managing change.

Annex 6

# Proposed Curriculum for Managers of Other Sectors

## BASIC MODULES

### Environmental health studies

*Prerequisites*
Course entry requirements.

*Learning objectives*
To enable students to:

- consolidate their awareness of the interdisciplinary and intersectoral nature of environmental health issues; and
- appreciate the holistic nature of environmental health and the application of a holistic approach to management of environmental health issues.

*Module content*
The emergence of the environmental movement.
Evolution of environmental health from national and international perspectives.
Emergence of sustainable development principles.
Practical applications of the intersectoral nature of environmental health.

### Public health and epidemiology

*Prerequisites*
Course entry requirements.

*Learning objectives*

To enable students to:

- develop an appreciation of public health and environmental health issues; and
- develop an appreciation of the intersectoral nature of health promotion.

*Module content*

Review of public health.
Determinants of public health and social implications.
Populations at risk.
Ethical and political considerations.

## Health promotion

*Prerequisites*

Course entry requirements.

*Learning objectives*

To enable students to:

- gain an overview of the development of health promotion practice;
- develop an appreciation of the main themes and models that contribute to the processes involved in health-related behavioural change; and
- develop an understanding of ethical principles and issues relating to health promotion.

*Module content*

Introduction to health promotion theory and practice.
Models of health promotion.
Health promotion research.
Review of theories of learning, attitudes, beliefs and values.
Principles of ethics and their relevance to health promotion.

## Health economics

*Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- consolidate their understanding of economic principles; and
- understand the mechanisms for developing and implementing budgets for environmental health services.

### *Module content*

Review of economic concepts and principles.

Main actors in microeconomic and macroeconomic issues.

Principles for developing and controlling budgets for environmental health services.

## APPLIED MODULES

These modules are seen as providing an opportunity for students to examine current developments and concepts in each of the areas below. As such, these modules share broadly similar sets of learning objectives and module content. The modules are the same as those provided for in the curriculum for environmental health service managers, but the contact teaching time has been increased and they are presented as electives, from which it is anticipated the students would select any four of the modules.

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- explore current trends and developments in the relevant areas; and
- carry out a critical appraisal of current literature in each of those areas.

### *Module content*

Introduction to and overview of topic.

Recent technical developments.

Current topics of concern.

Appraisal of scientific and other literature.

## INTEGRATED MODULES

### Toxicology

*Prerequisites*

Course entry requirements.

*Learning objectives*

To enable students to:

- gain an appreciation of the issues of toxic risk in the environment; and
- develop an understanding of strategies for preventing and reducing toxic risk.

*Module content*

Overview of the principles of toxicology.
Sources and nature of toxic risk.
Principles and practice of toxic risk management.

### Risk management

*Prerequisites*

Public health, epidemiology and toxicology.

*Learning objectives*

To enable students to:

- gain an appreciation of risk assessment and management concepts;
- understand the application of good risk assessment and management practice to a variety of scenarios;
- appreciate the integral role of risk perception in risk management; and
- appreciate the role of other actors in risk management issues.

*Module content*

Review of the principles and concepts of risk assessment and management.
Concepts of risk perception.

Risk management partnerships.
Risk management in emergency situations.

### Multimedia pollution control

*Prerequisites*
Basic and applied modules.

*Learning objectives*
To enable students to:

- consolidate their knowledge of the interrelationships between various pollution sources and exposure pathways;
- appreciate the necessity for an integrated approach to pollution prevention and control; and
- develop an overview of strategies for implementing integrated pollution control.

*Module content*
Global and local trends in pollution.
Mechanisms and sources of multimedia pollution.
Integrated pollution control concepts and techniques.

### Project case study report

*Prerequisites*
Completion of all other compulsory course modules

*Learning objective*
To enable students to carry out and present a critical analysis on a relevant environmental health topic within their own sector or field.

## HOLISTIC MODULES

### Environmental health impact assessment and auditing

*Prerequisites*
Basic and applied course modules.

### *Learning objectives*

To enable students to:

- develop an appreciation of environmental health impact assessment concepts; and
- investigate the current range of auditing and self-regulatory approaches in environmental health.

### *Module content*

Evolution and principles of environmental health impact assessment and auditing systems.

Application of "eco-auditing" and "eco-labelling" systems.

International developments in self-regulation mechanisms.

ISO and other international protocols.

## Environmental health policy and legislation

### *Prerequisites*

Course entry requirements.

### *Learning objectives*

To enable students to:

- gain an appreciation of the factors contributing to the development of national and international environmental health policy; and
- consolidate their understanding of current national and international environmental health legislation and policy.

### *Module content*

Overview of philosophical and political foundations for environmental health policy.

Emerging issues, long-term trends and future directions for environmental policy.

Review of current environmental health legislation.

Approaches and methodologies to drafting legislation.

## Health promotion

### *Prerequisites*

Health economics.

### *Learning objectives*

To enable students to:

- gain an overview of the development of the theories, values and models of health promotion that underpin current practice;
- develop an appreciation of the main themes and models that contribute to the processes involved in health-related behavioural change; and
- develop an understanding of ethical principles and issues relating to health promotion.

### *Module content*

Review of the evolution of health promotion theory and practice.
Models of health promotion.
Health promotion research.
Theories of learning, attitudes, beliefs and values.
Principles of ethics and their relevance to health promotion.

## Environmental health services evaluation

### *Prerequisites*

Environmental health economics and health promotion.

### *Learning objectives*

To enable students to:

- develop an understanding of the importance of evaluation in the management of environmental health services; and
- gain an appreciation of approaches to evaluating environmental health services.

### *Module content*

Principles and theoretical framework for evaluating environmental health services.
Instruments for evaluation.
Managing evaluation processes.
Good evaluation practices.
Role and limitations of evaluation in specific cases in environmental health services.

## OPTIONAL MODULES

### Environmental health education and methodologies

*Prerequisites*
Health promotion.

*Learning objectives*
To enable students to:

- gain an understanding of the principles of developing environmental health education programmes; and
- develop practical expertise in educational programme development and implementation.

*Module content*
Application of teaching and learning methods and course design.
Participatory methods in education and training.
Design and assessment of material.
Role of the mass media in health education.
Design and evaluation of programmes.
Examples of good practice.

### Linguistics

*Prerequisites*
Advanced level in relevant second language.

*Learning objective*
To enable students to consolidate their ability to deal with technical and professional issues in a relevant second language.

*Module content*
Critical review of current environmental health literature in a relevant second language.
Conducting and participating in seminars and meetings through a relevant second language.

### Environmental health economics

*Prerequisites*
Basic course module in environmental health economics.

*Learning objective*

To enable students to develop an understanding of the concepts of economic evaluation of environmental health services.

*Module content*

Review of economic concepts and principles.

Economic assessment of environmental health programmes, including cost–effectiveness and cost–benefit analysis.

Examples of good practice.

### Health promotion management

*Prerequisites*

Health promotion.

*Learning objective*

To enable students to:

- develop an appreciation of approaches to health promotion in relation to key settings and issues in society;
- gain knowledge of the opportunities and obstacles that exist in developing health promotion programmes; and
- gain an appreciation of the roles played by the networks of partners involved in health promotion in a variety of settings.

*Module content*

Identification of key settings and target groups for health promotion.

Review of current approaches to health promotion in society.

Review of the role of networks in health promotion.

Critical appraisal of examples of good practice.

# Guidelines for Developing and Evaluating Learning Objectives for Educational Programmes in Environmental Health

Learning objectives have been described in this book as the basis of relevant competence-based learning. In developing learning objectives, it is desirable to proceed sequentially from the general to the specific. The issues that might be addressed in developing such objectives for environmental health-related programmes include:

- assessment of the general and priority needs of the society served, with regard to the national status of environmental health;
- review of environmental health policy and of policies for environmental health education;
- appraisal of the structure and functions of those services that deliver environmental health services, and of the educational system;
- study of the current and envisaged functions, activities and tasks of relevant categories of environmental health professional within these systems;
- estimation of the availability of human and other resources;
- assessment of the characteristics of environmental health professionals, teachers and students;
- assessment of national scientific, technological and economic development; and
- appraisal of the cultural and value systems of the society.

## CHECK-LIST FOR EVALUATING EDUCATIONAL OBJECTIVES

Evaluation of the learning objectives of an educational programme is an intersectoral exercise, which should be carried out together by all the relevant stakeholders. The following check-list is a useful tool for developing the framework for this exercise.

1. Who are the actors in the evaluation process?

   - Teaching staff.
   - Practitioners.
   - Education specialists.
   - Students.
   - Public/private sector partners.
   - Consumers/public.
   - Others.

2. How was the final decision made to adopt these objectives?

   - By one individual.
   - By one department in the educational institute.
   - By an interdepartmental committee within the educational institute.
   - By an interdepartmental committee within the educational institute, in conjunction with other partners.

3. Given that the objectives should reflect the society's actual environmental health needs, which of the following needs are reflected?

   - Present and future environmental health problems.
   - Present and future functions of environmental health professionals and related disciplines.
   - Expectations of employers and clients.
   - Expectations of current practitioners.
   - Interrelationship of environmental health needs and other needs of the society.
   - Sustainable development.
   - National and international policy on environmental health.
   - Structure of existing and future environmental health services.

- Current level of knowledge on environmental health.
- Current and future planning for human resources in environmental health planning.

4. When the objectives were developed which of the following factors were considered?

   - Cost to the society.
   - Student characteristics.
   - Teaching facilities available.
   - Cultural setting of the educational institution.
   - Existing educational system and philosophies.
   - Orientation of political and professional organizations.

5. Does each objective describe a specific competence that is significantly related to the performance of one or more of the tasks of an environmental health professional?

6. Do the objectives represent an adequate sample of the expected professional competence?

7. Given that educational objectives are by definition student-oriented do they:

   - relate to the actual work the student is going to do after graduation; and
   - describe what the student will be able to do?

8. Given that the objectives should be consistent with one another, do some of them:

   - contradict others; or
   - support others?

9. Are the objectives realistic with regard to:

   - characteristics of students/teaching staff;
   - available facilities; and
   - time available for learning?

10. Given that the objectives should be directed towards significant results of learning in all domains (knowledge, skills and attitudes), are some of them specifically designed to facilitate:

    - personal development;
    - intellectual enquiry;
    - competence in teamwork/leadership;
    - research skills;
    - self learning/assessment skills;
    - problem-solving skills;
    - technical skills;
    - social responsibility; or
    - responsiveness to innovation?

11. Has the use of the objectives within the educational institution been considered and, if so, how was the final decision concerning their use made?

12. Have the students been informed of the learning objectives?

13. Have all the teaching staff been informed of the learning objectives?

14. On examination of the objectives, is it likely that:

    - they will be achieved;
    - they will facilitate student learning ;
    - they will facilitate an integrated approach to learning;
    - they will facilitate evaluation; or
    - they may not be used?

15. Has the statement of the objectives had any impact on the teaching/learning aspects or the evaluation methods?

16. Has provision been made for a periodic review of the objectives and, if so, is this review based on:

    - student performance data;
    - operational research data; or
    - evidence of changing needs?

17. Who are the actors involved in this periodic review?

- Teaching staff.
- Practitioners.
- Education specialists.
- Students.
- Public/private sector partners.
- Consumers/public.
- Others.

# Participants in Preparatory Meetings, 1995–1996

## Working Group Meeting on Environmental Health Services in Europe, Staffing, Professional Education and Training Project

**Dublin, Ireland, 2–4 March 1995**

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## Workshop on Staffing, Professional Education and Training Needs in Environmental Health Services for the Central Asian Republics

**Bishkek, Kyrgyzstan, 29 November – 1 December 1995**

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## Working Group Meeting to Review Guidance Document on Staffing of Environmental Health Services

### London, United Kingdom, 15–16 April 1996

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## Second Consultation of Senior Government Officials on the Development of National Environmental Health Action Plans

### Dubrovnik, Croatia, 21–23 October 1996

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